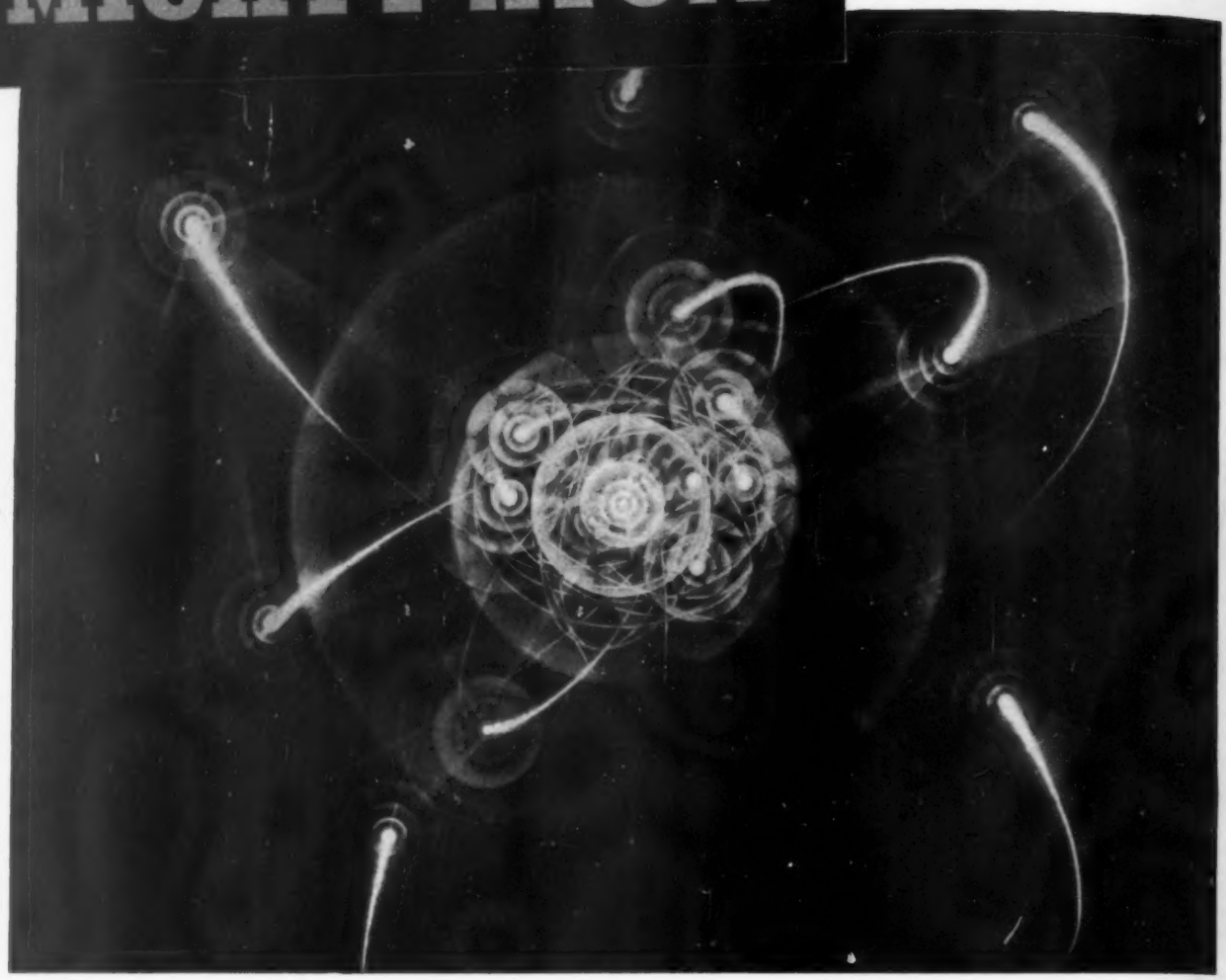
WATER WORKS & SEWERAGE

MIGHTY ATOM



THE illustration above is a graphic conception of the atomic structure of chlorine. The nucleus and its planetary electrons are shown in a relationship suggesting the origin of the chemical and physical properties peculiar to this interesting element. The complex mass relationships and forces are so balanced in the chlorine atom as to produce one of mankind's useful chemical servants.

Chlorine is a potent ally in both war and peace. Most of the million plus tons per year now being produced are earmarked for essential wartime and essential civilian uses. When victory comes, chlorine will again take up its many full-time roles in wide commercial application.

Among the nation's largest producers of chlorine are the Wyandotte, Michigan, and Tacoma, Washington, plants of the Pennsylvania Salt Manufacturing Company. It was from the Wyandotte plant that Penn Salt shipped America's first commercial quantity of liquid chlorine in 1909.

Wartime production of chlorine at Penn Salt has been a stimulus and an inspiration to our engineers to plan even wider usefulness for this important chemical servant, when peace returns.

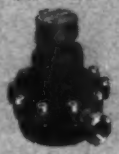
PENNSYLVANIA SALT
MANUFACTURING COMPANY
Chemicals

1000 WIDENER BUILDING • PHILADELPHIA

NEW YORK • CHICAGO • ST. LOUIS • PITTSBURGH • WYANDOTTE • TACOMA

DOING THE BIG JOBS WELL

EMCO Sewage Gas Meter



Pittsburgh Hot and Cold Water Meter

Nordstrom Lubricated Plug Valve

☆EMCO Sewage Gas Meters

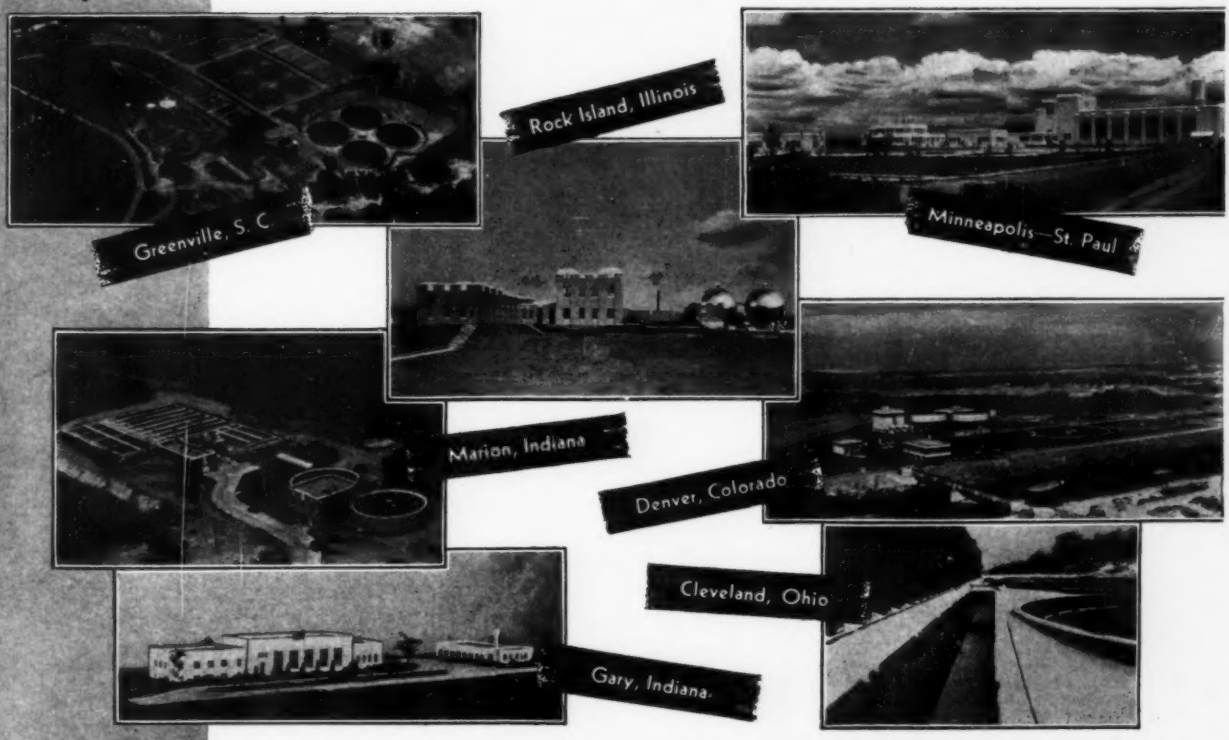
☆PITTSBURGH Hot and Cold Water Meters

☆NORDSTROM Lubricated Plug Valves

SEWAGE treatment and disposal practice has made tremendous strides during the past decade. The sewage plants erected during this era, and those projected, will function with the highest degree of efficiency and dependability through the foresight of their designers in the careful selection of all equipment. They will have a favorable effect on the health and well-being of large and small population centers alike for many years to come.

We are proud of the fact that our meters and valves have been specified for use in the majority of the largest sewage treatment plants that have been erected.

Accuracy in measurement and control is important to the efficient operation of any size plant. EMCO Sewage Gas Meters can be relied upon for the accurate measurement of all gas generated during sludge digestion which is used as a source of heat and power. Pittsburgh Hot and Cold Water Meters will definitely determine the cost of the large quantity of water consumed in and about the plant. Nordstrom Valves, due to their leak resistance, corrosion-proof construction, and easy, positive operation, provide absolute control and assure the most satisfactory service on all lines in sewage treatment plants.



PITTSBURGH EQUITABLE METER COMPANY

NEW YORK · BROOKLYN · DES MOINES · MEMPHIS · OAKLAND · TULSA · CHICAGO · BOSTON

MERCO NORDSTROM VALVE COMPANY
Main Offices, Pittsburgh, Pa.

NATIONAL METER DIVISION, Brooklyn, N. Y.

KANSAS CITY · PHILADELPHIA · SAN FRANCISCO · LOS ANGELES · SEATTLE · HOUSTON · COLUMBIA · BUFFALO

WATER WORKS & SEWERAGE, March, 1943. Volume 90. Number 3. Published monthly by Gillette Publishing Co., 330 South Wells Street, Chicago, Ill. Per copy, 25c. Subscription rate, United States, $2.00 per year; Canada, $2.00 per year; Foreign, $3.00 per year. Entered as Second Class Matter, June 2, 1931, at the Post Office at Chicago, Ill., under Act of March 3, 1879.

Diffuser plates are clogging much faster than formerly, report operators of many sewage treatment plants; they blame it on increased industrial waste. Where plates are mounted in Alcoa Aluminum diffuser plate holders, clogged plates are easily removed for cleaning and then put back in place.

Soaking these plates in an acid solution has heretofore been considered satisfactory for restoring their permeability. But Cleveland's Easterly plant wasn't satisfied, so they started gauging the efficiency of plates cleaned in various solutions. They found which solution gives best results, and they also discovered this—

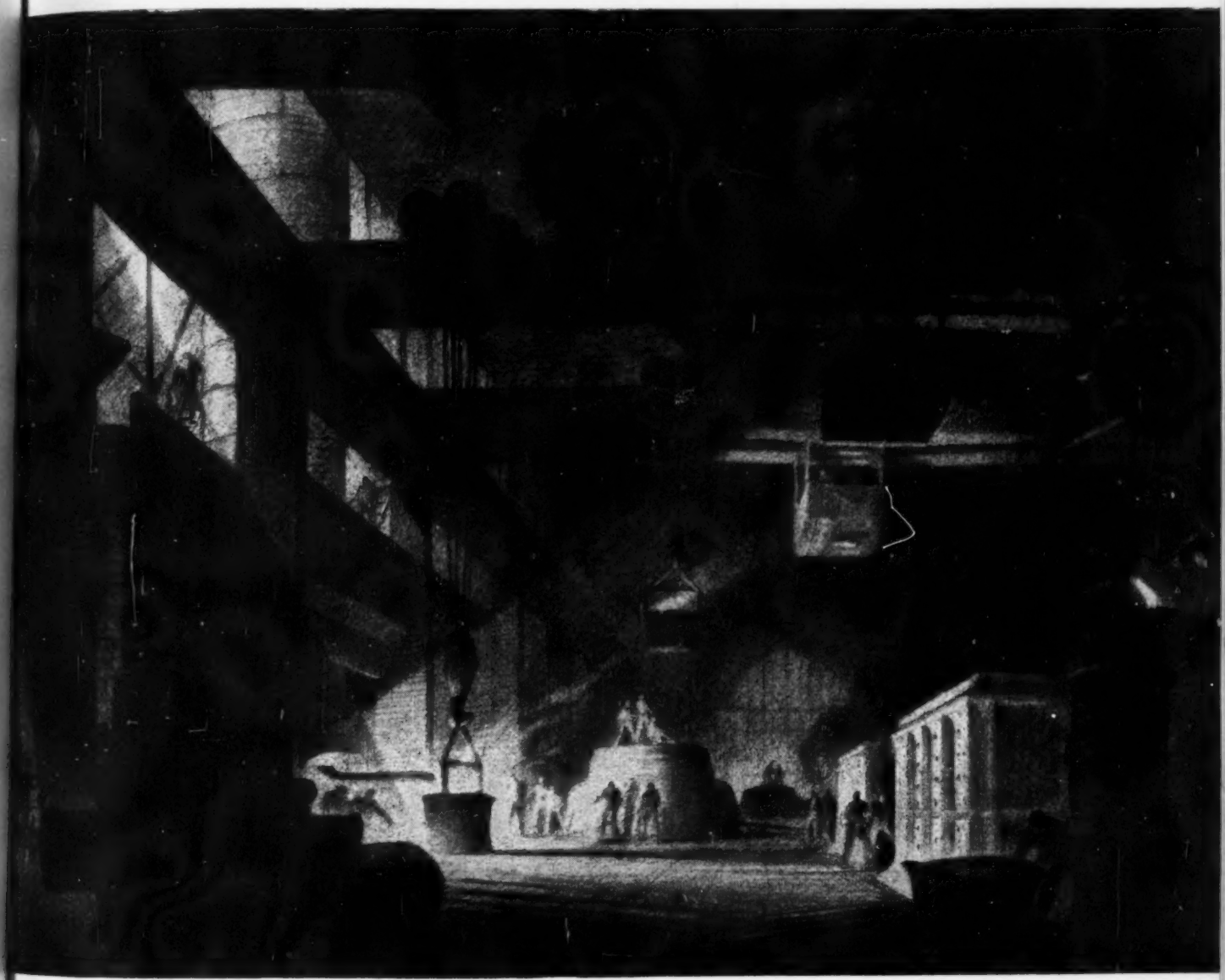
Flushing plates with air and water under pressure, when they're taken from the acid bath, clears out the pores and restores them to nearly 100% efficiency. The machine you see in the above photograph was built for this purpose, and it's at work constantly, keeping diffuser plates and the plant, incidentally, up to top efficiency.

Other plants, in which Alcoa Aluminum diffuser plate holders are installed, can also employ this same procedure profitably. ALUMINUM COMPANY OF AMERICA, 1955 Gulf Building, Pittsburgh, Pa.

ALCOA ALUMINUM

Pipe founders plus

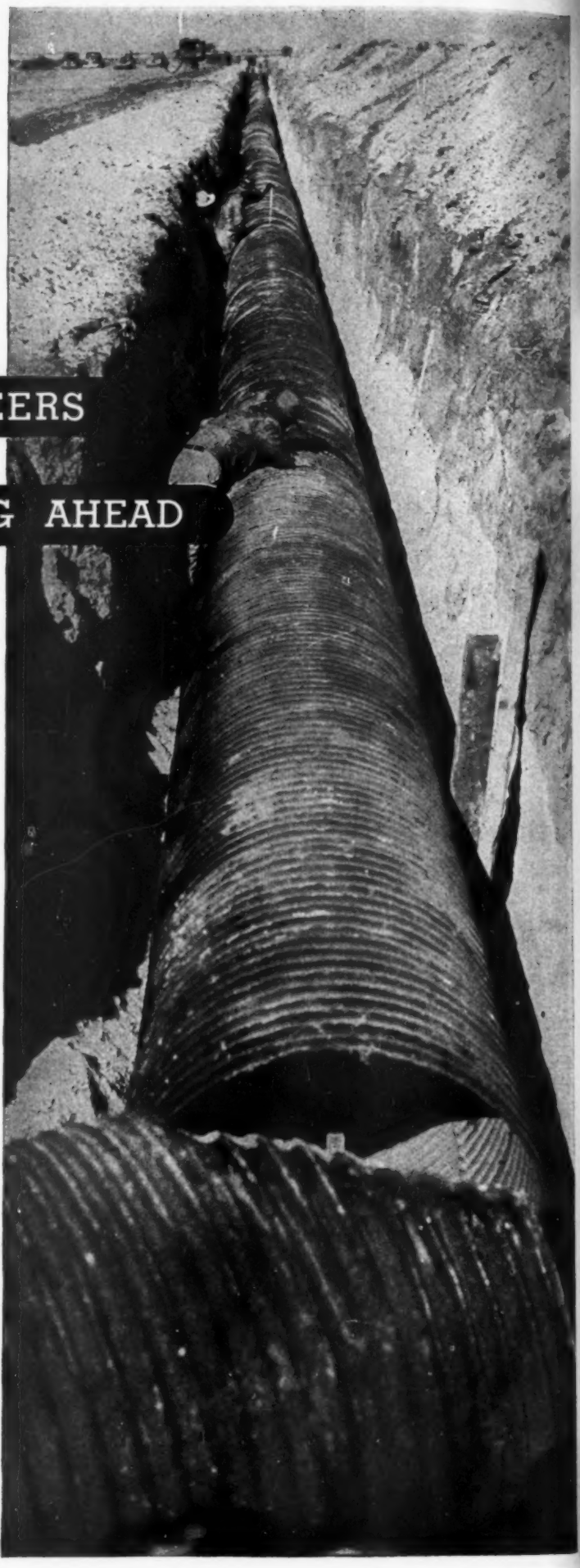
You may know us as America's largest producer of cast iron pipe but not be aware that we have exceptional facilities to cast and completely machine special castings in accordance with engineers' designs and specifications. Many of them, now — machine tool, marine engine and dry dock castings—are being made for the furtherance of the war effort. Our special castings foundries, and a specialized plant for the manufacture of fittings, are equipped to meet unusual industrial requirements, particularly in the process industries, as well as in the water supply, gas and sewerage fields. Our technical and laboratory staffs are experienced and resourceful. We invite you to take up with us any problems you may have in connection with the design of pipe, fittings or special castings for present or post-war requirements.



A special castings foundry at one of our plants, drawn by Hugh Ferriss.

UNITED STATES PIPE & FOUNDRY CO.

General Offices: Burlington, New Jersey. *Plants and Sales Offices throughout the U. S. A.*



FOR SEWER ENGINEERS

WHO ARE LOOKING AHEAD

Future-thinking engineers will be interested in this airport drainage story: Engineering integrity demanded a pipe with safe strength to handle heavy loads. Since the port was to continue in use after the war, economy dictated that the system be as durable as possible. Designers solved the problem with Asbestos-Bonded Paved Pipe.

The flexible corrugated metal design of ARMCO Pipe prevents breakage; and band couplers make for strong, tight joints. Longer lengths and fewer joints mean lower installation costs. Cradling is unnecessary. Corrosion is shackled by a full bituminous coating tightly bonded to the base metal. A thick bituminous pavement checks erosion—makes the bottom last as long as the top.

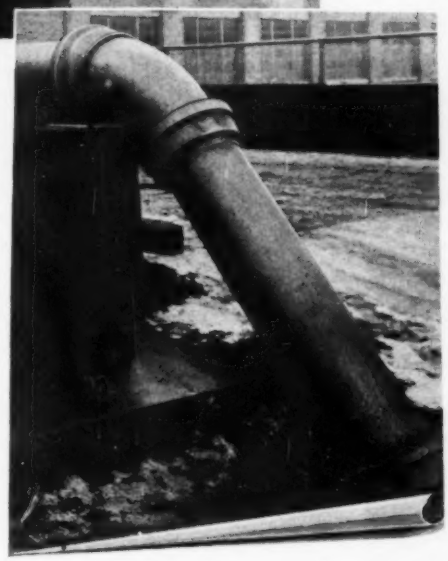
It will pay you well to keep Asbestos-Bonded ARMCO Sewer Pipe in mind for post-war projects even though you may not be able to get it for immediate construction. After the war it again will be available to help solve your toughest sewer problems. Armco Drainage Products Assn.. Middletown, O.

★ ★ ★ ★

ASBESTOS-BONDED
ARMCO SEWER PIPE

TIGHT JOINTS *days sooner*

with this Sulphur-Thiokol Base *Compound*



Today TIME is more precious than ever before. In water line construction it can be conserved by faster laying and speedier clearing up. Because Tegul-MINERALEAD's sulphur base includes THIOKOL (synthetic rubber), joints made with this compound show much less initial leakage and perfectly tight joints are obtained in a much shorter period of time.

To these important facts, add that *Tegul*-MINERALEAD, in the form of 10 lb. ingots, is more easily handled, needs no skilled labor, caulking or deep bell holes; is impervious alike to water and to composition changes (which occur in some compounds due to "shaking down" in transit from factory to job); weighs only one-fifth as much as lead—and goes three times as far; melts without sediment and pours and sets quickly, materially reducing labor costs.

More FIGHT in Every Joint

Add further that joints made with *Tegul*-MINERALEAD have much higher resistance to mechanical shock and vibration, and stand up under conditions that destroy lead —and that this is the only practical compound for lines carrying hot water, or subject to alternately high and low temperatures.

The sum total of these *Tegul*-MINERALEAD advantages is a definite

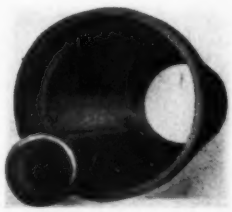
Saving in TIME, TROUBLE and $ & ¢

that you can hardly afford to overlook when you plan the laying of bell and spigot lines.

Tegul-MINERALEAD is available quickly from conveniently located distributing points.

For more information about this better jointing compound, address our branch office nearest you. For technical literature, write our head office here at Mertztown, Penn.

Tegul-MINERALEAD



1. Heavy Railroad traffic below, heavy highway traffic above, twenty-four hours a day. Years of this heavy vibration has not bothered the *Tegul*-MINERALEAD jointing.

2. 36° F. is too low a temperature at which to work some jointing compounds. *Tegul*-MINERALEAD works perfectly, even at this low temperature.

3. Pipe diameters don't trouble *Tegul*-MINERALEAD. This compound takes them in its stride from 6" and less to 48" and more.

The ATLAS MINERAL Products Company
OF Mertztown PA. Pennsylvania

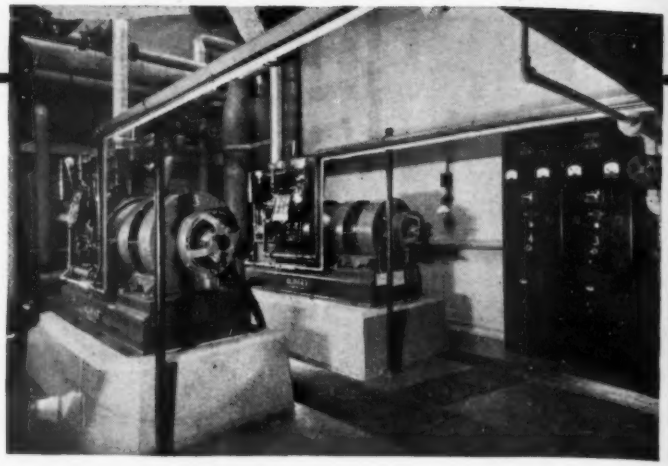
*ATLANTA, Ga. 610 Red Rock Building
*CHICAGO, Ill. 333 No. Michigan Ave.
*DALLAS, Tex. 3921 Purdue Street
*DETROIT, Mich. 2970 W. Grand Blvd.
*KANSAS CITY, Kan. 1913 Tauromee Ave.
NEW YORK CITY, 280 Madison Ave.
PITTSBURGH, Pa. (10) 4656 Old Boston Rd.
TORONTO, Ont., McRae Engineering Equipment, Ltd. 11 King St., West

The ATLAS MINERAL Products Company of California
REDWOOD CITY, California

*DENVER, Colorado, 1921 Blake Street
*HONOLULU, Hawaii, U. S. A.
*LOS ANGELES, Cal., 817 Yale Street
*SEATTLE, Wash., H. D. Fowler Company 558 First Avenue, South

*Stocks carried at these points

VICTORY EFFORT CALLS FOR CONSERVATION OF LEAD, A STRATEGIC WAR METAL



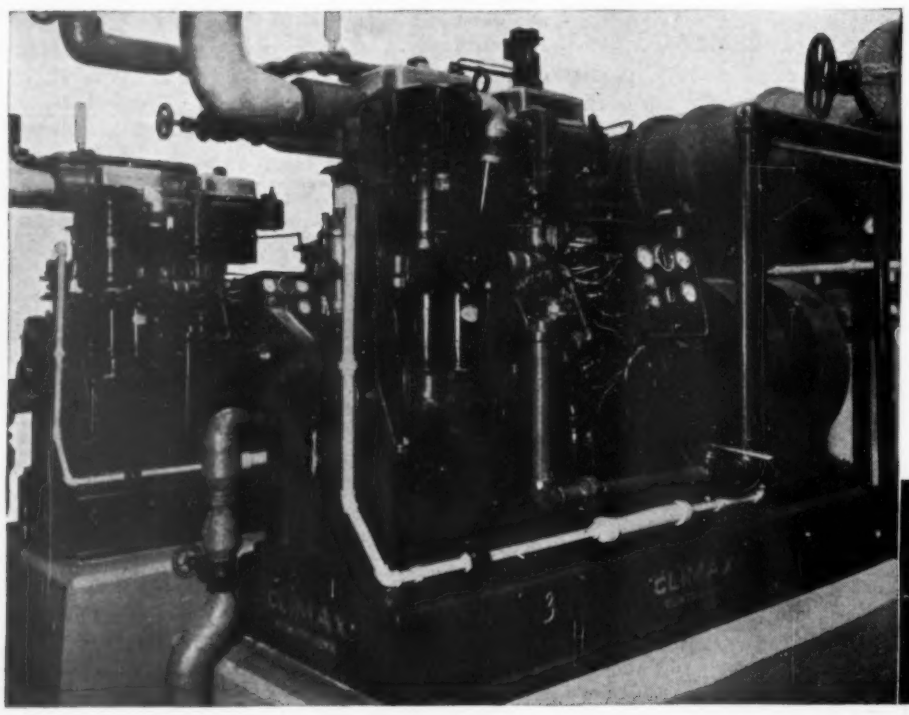
Total Power from Sewage Gas with Climax Engines and Generating Sets

MAKES MONEY FOR AURORA, ILLINOIS SANITARY DISTRICT

THE PLANT consists of two Climax R61, 75-hp. Sewage Gas Engines driving two 8 M.G.D. pumps, and two Climax R41, 50-hp. Engines direct connected to Electric Machinery Mfg. Co., 44 KVA, 30 KW, AC generators. 69 months operation of pump engines and 15 months operation of generating sets earned Aurora a net profit of $25,135.85 on a total investment of $18,321.78.

METHOD OF OPERATION—The generating sets are arranged for parallel operation with automatic speed synchronization. Either unit is capable of carrying the normal load of the entire plant continuously. In practice, one engine is run for seven days continuously (24 hrs. a day) every other week. During this time one engine carries the normal full load.

The weekly change-over is made in the following manner. The idle engine is started by compressed air and brought up to rated speed. Then it is paralleled automatically with the engine under load. When the speed of both engines is perfectly synchronized, the load is transferred through a control switch, and power delivery is continued without loss or interruption. The engine formerly operated is then shut down.



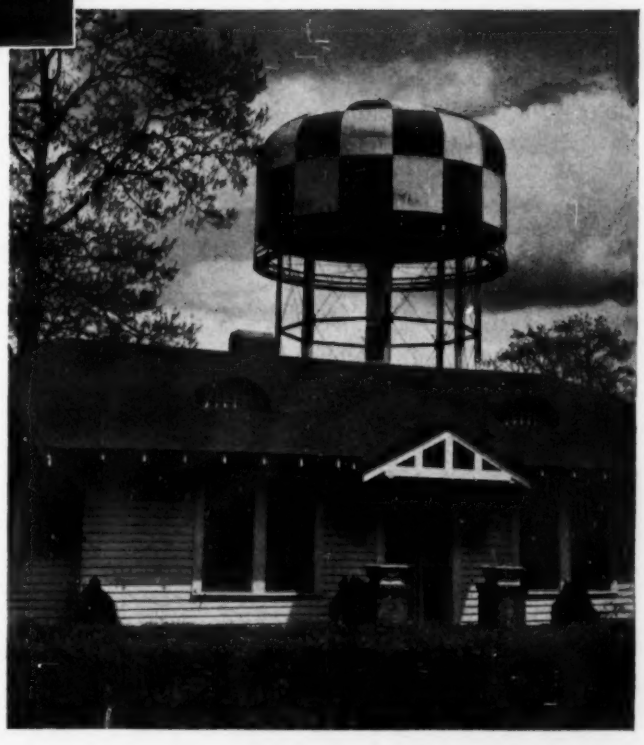
In emergencies—flooding of roads, streets, etc., or other conditions creating excess load—both engines are operated in parallel, and furnish power for the two 8 M.G.D. pumps.

•

WRITE for information. Let Climax Engines and Generating Sets reduce your operating costs, end power bills, and put you "on your own" at a profit. Address Department K.

Climax Engineering Company
GENERAL OFFICES & FACTORY:
CLINTON, IOWA
REGIONAL OFFICE: DALLAS, TEXAS

Another half million gallon ELEVATED TANK for JACKSON MISSISSIPPI



LIKE many municipalities, Jackson, Mississippi, is utilizing two Horton elevated tanks to provide adequate water pressure, dependable fire protection and reduce operating costs. One of the units—a 500,000-gal. radial-cone bottom elevated tank is shown above and the original 500,000-gal. unit is shown at the right.

The first tank was located in the western section of the city to provide gravity pressure in that area. It is filled at off-peak periods and provides pressure that does not fall below 50 lbs. Formerly pressure in that area ranged from 55 to 30 lbs. per sq. in. The second unit was installed in the northern portion of the Jackson waterworks system. It, too, is filled at off-peak periods and, in addition to maintaining uniform pressures throughout the district, also relieves the main pumping station of some of the heavy load.

CHICAGO BRIDGE & IRON COMPANY

Chicago.....2198 McCormick Bldg.	Birmingham..1586 North 50th Street	Philadelphia...1644-1700 Walnut St.
New York.3390-165 Broadway Bldg.	Tulsa.....1646 Hunt Bldg.	Washington.....330 Bowen Bldg.
Cleveland.....2262 Guildhall Bldg.	Houston.....5615 Clinton Drive	San Francisco.....1083 Rialto Bldg.
Havana.....402 Edificio Abreu		Greenville.....York Street

Plants at BIRMINGHAM, CHICAGO, *and* GREENVILLE, PA. *In Canada:* HORTON STEEL WORKS, LIMITED, FORT ERIE, ONT.

My lovely Tablecloth...

IT'S blue Monday with a vengeance for this lady. No woman will take damage to her treasured fabrics without giving the water company an earful. And what will you tell her? Nothing you can say will restore the whiteness to her fine linens.

But you can give her some hope that "red water" will soon be a thing of the past. In fact, hundreds of cities have already eliminated this nuisance with simple Calgon treatment.

Here's how it works. "Red water" is usually caused by corrosion from soft water or by precipitation of dissolved iron from well water. Calgon controls both kinds.

A treatment of 1 to 5 ppm. Calgon maintains a thin protective film over pipe metal and metal oxides throughout the system. This reduces the attack of oxygen so effectively that corrosion ceases to be a serious problem and "red water" is eliminated.

"Red water" from wells containing dissolved iron can be eliminated with similar treatment. In this case, however, Calgon prevents the precipitation of dissolved iron so that no heavy accumulations occur. "Red water" doesn't get a chance to form. This eliminates the need for expensive iron removal equipment.

Calgon treatment can be started immediately. The cost is extremely low. The only apparatus needed is a device to assure correct feeding. Write for samples and complete information which also shows how Calgon* prevents scale and stabilizes water after lime-soda softening.

HERE'S THE CULPRIT. *Corrosion in the pipe lines causes "red water"... and in this case it riddled the pipe in about six months. Calgon treatment controls corrosion, preventing "red water."*

CALGON SOLVES 4 WATER WORKS PROBLEMS

1. **Prevention of scale** from hard, high-bicarbonate waters. Calgon, added at the plant, prevents scale formation in mains, meters and hot-water heaters, throughout the system.
2. **Corrosion control** — Calgon forms a thin protective film on metals and metal oxides at pH values of 5.0 and higher. This reduces the attack of oxygen to such an extent that corrosion ceases to be a problem.
3. **Prevention of "red water"** — Calgon prevents the precipitation of dissolved iron. Thus "red water," either from iron initially present in well water, or from corrosion, can be eliminated.
4. **Stabilization of water** following lime or lime-soda softening. Calgon's ability to prevent precipitation of calcium carbonate stabilizes water to the ends of the system.

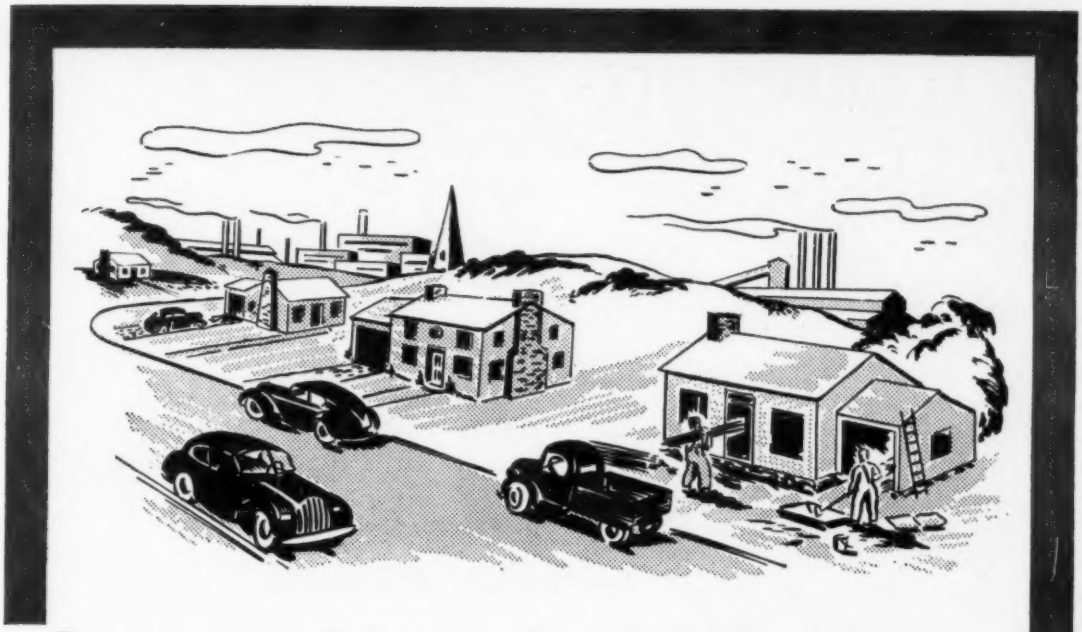
**Calgon is the registered trade-mark of Calgon, Inc. for its glassy sodium phosphate products.*

HAGAN
HALL
BUROMIN
CALGON

calgon, inc.

A SUBSIDIARY OF HAGAN CORPORATION

HAGAN BUILDING
PITTSBURGH PA



You can do something about tomorrow-

Today

RIGHT NOW, VICTORY COMES FIRST. America is in the middle of the biggest job it ever tackled—the job of winning a war. And it's full time work.

But, remember, there's a tomorrow coming—a tomorrow of peacetime rebuilding for a world that has long been denied many things that are essential to normal living. There's hardly a community that will not be affected. New homes—new industries—new demands on municipal service. Equipment for water conditioning and sewage treatment, though perhaps adequate for today, may be severely taxed by the needs of tomorrow. And the time to plan for these demands is today.

In anticipating your needs for replacement of equipment or expansion of your facilities, consult Graver. Hundreds of installations in municipalities all over the country attest to the exceptional efficiency and economy of Graver equipment. Our engineers will gladly advise with you on any specific problem of water conditioning or sewage treatment, and they're backed by years of experience in this highly specialized work.

Write Graver—today. There's no obligation.

WATER SOFTENERS
FILTRATION SYSTEMS
CLARIFIERS
SEWAGE EQUIPMENT
STEEL STORAGE TANKS
VAPOR CONSERVATION SYSTEMS
WELDED CONSTRUCTION
STRESS RELIEVING
X-RAYING
FABRICATED STEEL AND CORROSION-RESISTING PLATE

GRAVER

GRAVER TANK & MFG. CO., INC.

NEW YORK
CATASAUQUA, PA.

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CABLE ADDRESS — GRATANK

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TULSA

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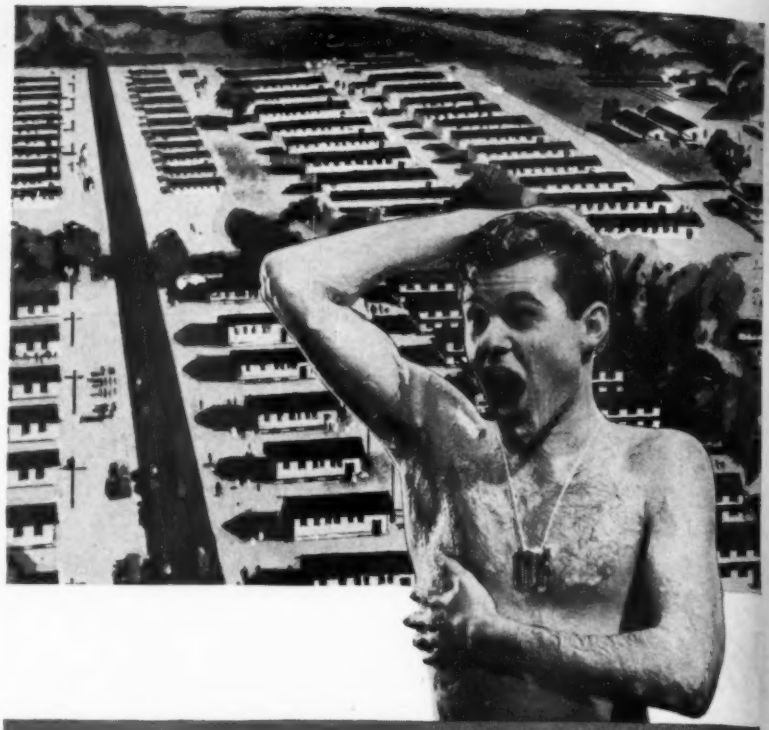
NOW AT SOLDIER CITY *SOFT WATER BY PERMUTIT*

After the war, your city, too, can enjoy good water—plan it now! Camps are like good-sized cities—they need good water. Permutit* equipment is helping to supply many of them with soft, clear, iron-free water for post hospitals, laundries, kitchens, swimming pools, power plants—as well as for general community use.

That's why Permutit cannot now supply installations for *your* city. But when Victory is won, Permutit equipment—more practical and economical than ever—will be available for *every* municipality. Prepare *now* for this public improvement in your community. Just drop a line to The Permutit Company, Dept. G1, 330 West 42nd St., New York, N. Y. In Canada: Permutit Company of Canada, Ltd... Montreal . . Toronto . . Winnipeg . . Calgary.

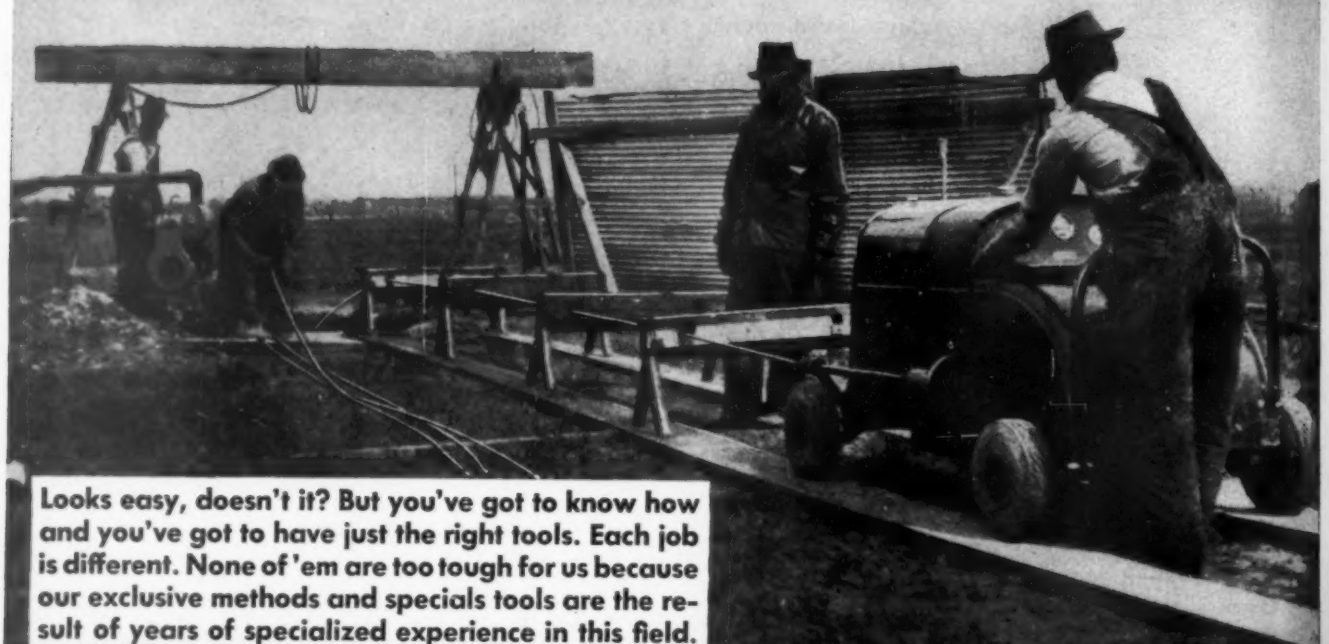
*Trademark Reg. U. S. Pat. Off.



PERMUTIT

WATER CONDITIONING HEADQUARTERS

Water Main Cleaning is a Job for Specialists!

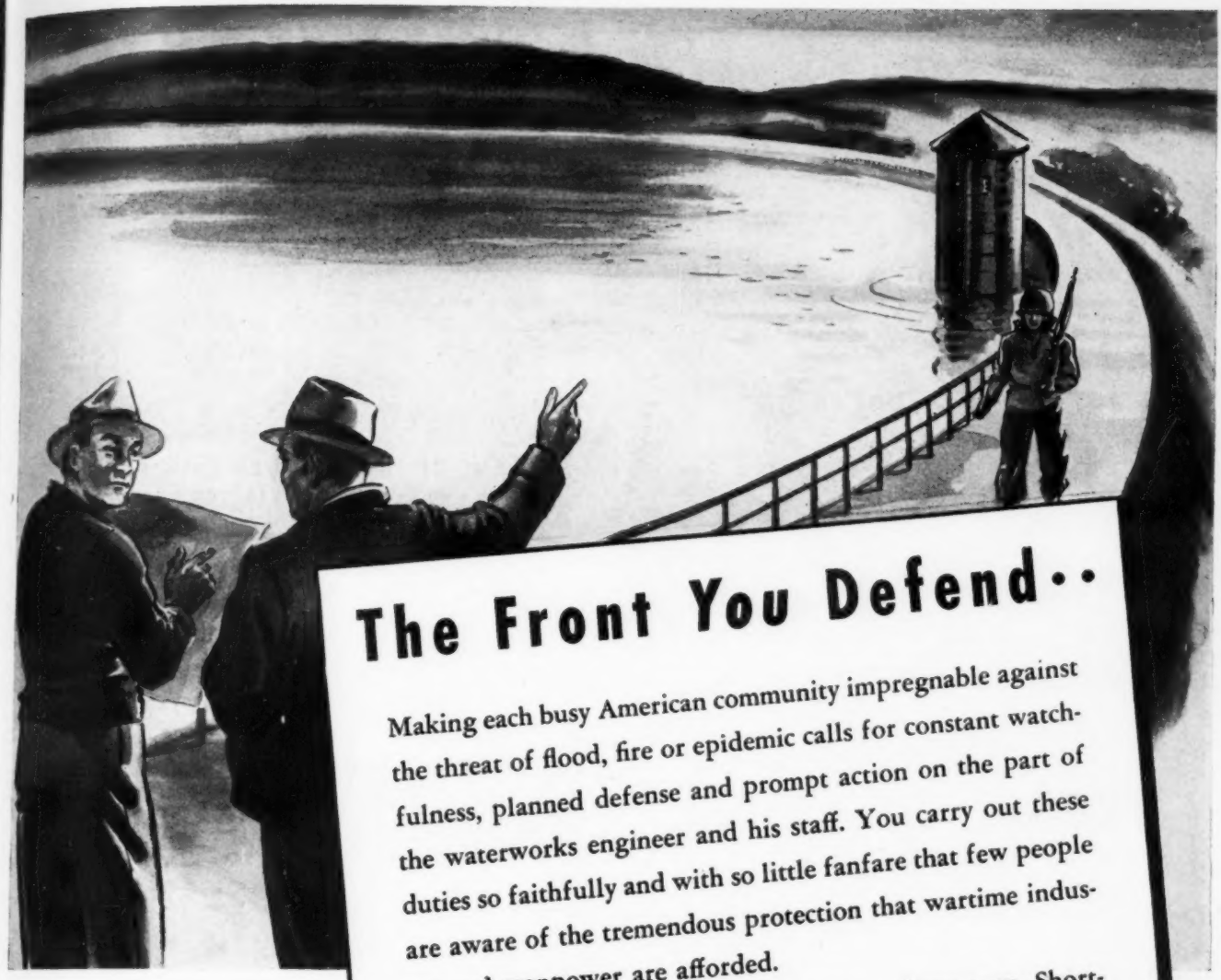


Looks easy, doesn't it? But you've got to know how and you've got to have just the right tools. Each job is different. None of 'em are too tough for us because our exclusive methods and specials tools are the result of years of specialized experience in this field.

FLEXIBLE UNDERGROUND PIPE-CLEANING CO.

9059 Venice Boulevard, Los Angeles, Calif.

401 BROADWAY, NEW YORK • 1624 HARMON PLACE, MINNEAPOLIS • PICKWICK BLDG., KANSAS CITY



The Front You Defend··

Making each busy American community impregnable against the threat of flood, fire or epidemic calls for constant watchfulness, planned defense and prompt action on the part of the waterworks engineer and his staff. You carry out these duties so faithfully and with so little fanfare that few people are aware of the tremendous protection that wartime industry and manpower are afforded.

Ludlow realizes that your job has not been easy. Shortages and restrictions on new equipment and supplies necessitate conversion, repair and re-use of the material at hand. However, it is often easier to obtain priority for replacement parts than for complete units—and insofar as this applies to Ludlow Valves, we will give you all possible cooperation.

V-8

THE LUDLOW VALVE MFG. CO., INC.
TROY, N. Y.

LUDLOW VALVE CONSTRUCTION: Self-releasing 30° angle wedges and free-floating gates, self-adjusting to seats, afford smooth action, tight closure, long service regardless of frequency of use. Rings cleaned throughout stroke action. Gates are wedge-locked directly opposite ports and completely unwedged before raising. Ample tolerances provide free movement. Simple construction permits easy replacement of parts.

LUDLOW VALVES AND HYDRANTS

SINCE 1866

FOR

GAY GOWNS AND PUBLIC HEALTH

HOOKER FERRIC CHLORIDE SOLUTION

The same Ferric Chloride on which you rely in your sewage treatment, serves also as a mordant in dyeing and printing textiles. In both cases it is important for the buyer to know that the quality and uniformity of the product are carefully guarded by the producer, as they are here at HOOKER. On these specifications you can rely at all times:

HOOKER SPECIFICATIONS

FERRIC CHLORIDE SOLUTION

Description: Dark, orange-red colored sirupy liquid.
$FeCl_3$ .....40% minimum—50% maximum
$FeCl_2$ .....0.20% maximum
Shipped in 13 gal. carboys containing 150 lbs., and in tank cars.

Other HOOKER Chemicals for water works and sewerage use include Caustic Soda and Liquid Chlorine.

HOOKER ELECTROCHEMICAL COMPANY

Niagara Falls, N. Y. Tacoma, Wash.
New York, N. Y. Wilmington, Calif.

ARMY E NAVY
HOOKER · ELECTROCHEMICAL · COMPANY

HOOKER CHEMICALS

3676

THE ACCELO-FILTER

SAVE PIPING AND PUMPING COSTS OBTAIN HIGHER EFFICIENCY WITH DIRECT RECIRCULATION IN THE

ACCELO-FILTER

Activators
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INFILCO

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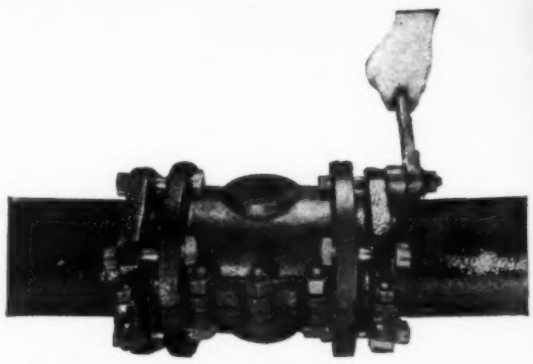
WRITE FOR BULLETIN 2415

INFILCO INCORPORATED

FORMERLY INTERNATIONAL FILTER CO
325 W. 25th PLACE, CHICAGO, ILL.



QUICK — ECONOMICAL — EFFECTIVE

repairs of broken pipe can be made with Doublex Simplex Split Sleeves. Attractively priced. All sizes—2 inches through 36 inches. Makes a good tapping sleeve, too.

"Peevish Pete" the Pipe Peddler Says:

"I can't get around as often as I'd like to, but am still making special efforts to meet special problems and can make some trips. Send me a postcard."

AMERICAN CAST IRON PIPE COMPANY

BIRMINGHAM, ALABAMA

Dallas Houston El Paso
Pittsburgh Kansas City Chicago
Minneapolis New York City
Cleveland Los Angeles
San Francisco

• Conservation at home is a vital factor in the supply of our armed forces. During the past two years, hundreds of miles of sturdy, long-lasting Lock Joint pipelines have been built to supply vital war projects, yet in the very construction of these lines, more than 80,000 tons of ferrous metals have been conserved for the war effort—enough tonnage to build more than 3,000 medium tanks.

This conservation of metal is possible without any sacrifice of quality because Lock Joint Pipe can be "tailor-made" to fit your job.

LOCK JOINT PIPE COMPANY

Established 1905

AMPERE, NEW JERSEY

Denver, Colo. • Chicago, Ill. • Kenilworth, N. J. • Kansas City, Mo. • Rock Island, Ill.
White Plains, N. Y. • Valley Park, Mo. • Cleveland, Ohio • Hartford, Conn. • Navarre, Ohio

SCOPE OF SERVICES *Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply Mains as well as Concrete Pipe of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous lines.*

LOCK JOINT
Reinforced Concrete
PRESSURE PIPE

PHOTO OF TYPICAL GATE VALVE INSTALLATION
ELECTRICALLY CONTROLLED

THESE VALVES STAND THE TEST

The real proof of the worth of any valve is how it measures up to "on the job" conditions. It must function at any time day or night no matter how many years it has been buried. It must operate smoothly without binding or sticking. It must close tightly without leaking. It must give long service with a minimum of upkeep cost. . . . MUELLER-COLUMBIANS are those kind of valves.

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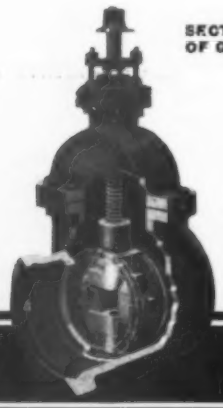

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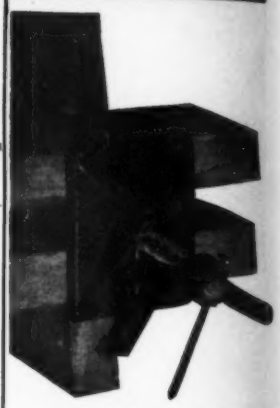

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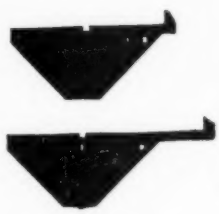

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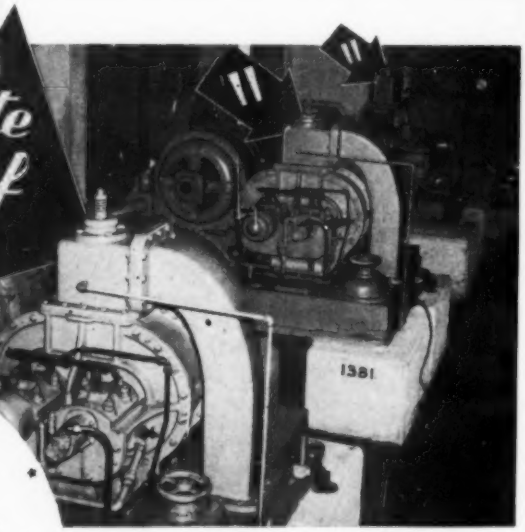

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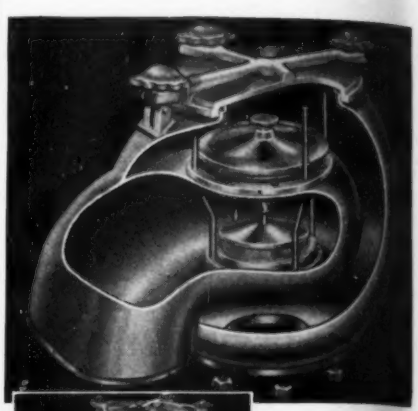

Cutaway Section of Figure No. 30 "VAREC" approved Pressure Relief and Vacuum Breaker Valve.

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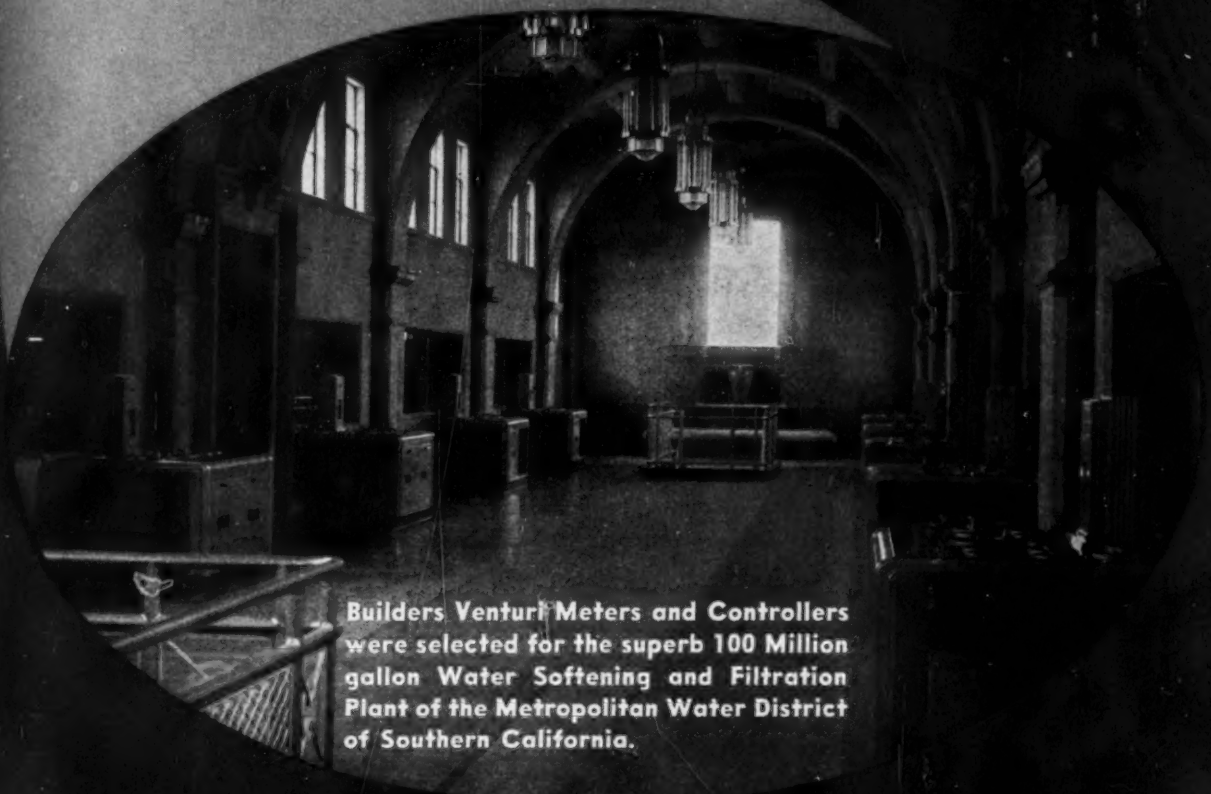

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WATER WORKS & SEWERAGE

VOL. 90, No. 3 — *A Gillette Publication* — MARCH, 1943

THE HARDY CROSS METHOD

Its Practical Application in Determining Flows and Heads in Pipe Systems

By D. R. TAYLOR*
Superintendent
ROANOKE WATER DEPARTMENT
ROANOKE, VIRGINIA

PART I

Fundamentals and Elementary Use

The Author

SINCE the first water pipe system of bored logs was installed, water works engineers and operators have sought a single and sound method of evaluating quantities of flow and resulting heads in pipe systems. Many methods have been devised, most of which have been either highly technical, or too cumbersome or onerous.

A few years ago Hardy Cross, then Professor of Structural Engineering at the University of Illinois and now Professor of Civil Engineering at Yale University, devised and produced a method* that was welcomed by engineers and operators and one that was and is being rapidly adopted as "the method." The method in detail was published in 1936 by the University of Illinois Experiment Station—"Analysis of Flow in Networks of Conduits and Conductors," Bull. 286.

Many conversions and adaptations of this method have been advanced, all of which have merit. Of especial merit is the simplified system presented by James J. Doland, Professor of Civil Engineering, University of Illinois. The main attractiveness of the Doland modification is that the determinations are for percentages of total flow and therefore, after calculations for any particular pipe network have been made, they may be applied to any quantities of flows without recalculating the system, provided, of course, that the take-offs (illustrated later) remain proportionate.

The Hardy Cross Method is based on fundamentals, is absolutely sound and is simple and convenient to use when properly understood. It is the purpose of the author to present an explanation and simple practical examples of the Doland system using the Hardy Cross Method.

*Since the writing of this article the author has entered the Army as Captain of U. S. Engineers, assigned to duty with the Fourth Service Command.

To Begin at the Beginning—

Although the method is applicable to any of the flow formulas, the system herein presented is based on the Hazen and Williams formula.

While an assumption must be made at the beginning, it does not have to be even a good one, because one of the inherent characteristics of the method is that it reveals whatever error there may be in the first assumption in an exact percentage, making the second trial factual in every respect.

It is a well understood fundamental, that if a flow is divided between two pipes of equal size, length and smoothness, that the same quantity will flow through each pipe and that the friction loss in each pipe will be equal. This is illustrated in Fig. 1.

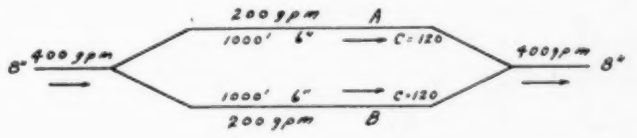


FIG. 1—BALANCED FLOW

Another fundamental is that if the two pipes are of *different* diameter, length and smoothness, that such a quantity will flow through each pipe, that will produce the same total friction loss in each pipe. Calculating these quantities has heretofore been difficult to determine, but the Hardy Cross Method answers these questions simply and with the least amount of effort on the part of the explorer.

Nomenclature

The following nomenclature will be used:

d = diameter in inches
D = diameter in feet
Q_m = quantity of flow in gallons per minute

Q_d = quantity of flow in gallons per day
S = friction loss per 1000 feet
S_t = total friction loss for any length
r = a resistance factor, depending upon size and smoothness of pipe
k = 100,000 r (100,000 times r)
h_f = a friction loss factor
H = head in feet
C = coefficient of friction
P = pounds per square inch

Fundamental Formulas

(1) $S = r\ Q_m^{1.85}$

(2) $r = \dfrac{S}{Q_m^{1.85}}$

(3) $k = 100{,}000\ r$

(4) $k \times Q_m^{0.85} = kQ_m^{0.85}$

(5) $kQ_m^{0.85} \times Q_m = h_f$

(6) $S_t = \dfrac{\Sigma\ (\text{sum of})\ h_f}{100{,}000}\ (0.01\ Q_m)^{1.85}$

(7) $Q_d = 1440\ Q_m$

An Example of Application

Assume an 8 in. pipe with C = 110 and Q_m = 695 (one million gallons per day). Prove formulas 2, 5 and 6.

From Hazen and Williams tables S = 12.7 feet.

$$\text{By (2)}\ r = \frac{12.7}{(695)^{1.85}} = \frac{12.7}{180{,}990} = .00007$$

The values of r being such large and cumbersome fractional numbers, for convenience they are multiplied by 100,000 and the resulting values called (k).

These k values are tabulated in Figure 2. [For instance, .00007 × 100,000 = 7, which is k for 8″ pipe having a C value of 110.]

Figures 13, 14, 15 and 16 give values of exponential powers of numbers sufficiently close for practical use. For extreme accuracy (academic use) logarithms or cologarithms may be used (see tables 146 and 147, Handbook of Hydraulics, Horace W. King, 1939).

Fig. 2—Values of k for 1000 Feet of Pipe Based on the Hazen-Williams Formula

d—inches	C = 90	100	110	120	130	140
4	300	248	208	177	153	133
6	41	33.7	28.4	24.2	20.9	18.2
8	10	8.4	7.0	6.0	5.2	4.5
10	3.4	2.8	2.4	2.0	1.7	1.5
12	1.5	1.2	1.0	.83	.71	.62
14	.66	.55	.46	.39	.34	.30
16	.35	.29	.24	.20	.18	.15
18	.20	.16	.14	.12	.10	.09
20	.12	.10	.08	.07	.06	.05
24	.049	.04	.03	.03	.02	.02
30	.016	.013	.011	.010	.008	.007
36	.0067	.0054	.0046	.0039	.0034	.0030

FIG. 2

Using the assumed values in this example, in which 100 per cent of the flow is through the pipe being considered, we find that,

$Q_m^{0.85} = (100)^{0.85} = 50.12$

By (5), $h_f = 7 \times 50.12 \times 100$ (k = 7, from fig. 2)
$= 35{,}084$
$= 35{,}084$

By (6), $S_t = \dfrac{}{100{,}000} \times (6.95)^{1.85}$
$= .35084 \times 36.11$ (fig. 13)
$= 12.7$ feet

Fig. 3—Values of the 0.85 Power of Numbers

N	0	1	2	3	4	5	6	7	8	9
0	0	1.0	1.8	2.5	3.2	3.9	4.6	5.2	5.9	6.5
10	7.1	7.7	8.3	8.9	9.4	10.0	10.6	11.1	11.6	12.2
20	12.8	13.3	13.8	14.4	14.9	15.4	15.9	16.5	17.0	17.5
30	18.0	18.5	19.0	19.5	20.0	20.5	21.0	21.5	22.0	22.5
40	23.0	23.5	24.0	24.5	25.0	25.4	25.8	26.4	26.8	27.3
50	27.8	28.2	28.7	29.2	29.6	30.1	30.6	31.0	31.4	32.0
60	32.4	33.0	33.3	33.9	34.2	34.7	35.1	35.6	36.0	36.5
70	37.0	37.4	37.9	38.3	38.8	39.1	39.6	40.0	40.5	41.0
80	41.5	42.0	42.4	42.8	43.3	43.7	44.1	44.5	45.0	45.4
90	45.8	46.3	46.7	47.1	47.6	48.0	48.4	48.8	49.2	49.6

FIG. 3

This value agrees with that originally taken from the H & W tables.

Procedure

The procedure is this simple: A network of pipes is considered as a group of closed circuits and each circuit is considered to have two loops, either or both of which may consist of several sizes of pipes. A balanced condition (flow) exists only when a force (friction loss) in one loop (for convenience the clockwise force is considered first) is equal to the force in the opposite (counter clockwise) direction. A percentage of the total flow is first assumed to flow around each loop of a closed circuit and the value of h_f, depending upon the quantity of flow, is calculated for each loop. To satisfy the hydraulic fundamental previously mentioned, the friction loss in each loop will be equal if the original assumption as to quantity of flow in each loop is correct. If the assumption is not correct, the calculation reveals the percent of error. It shows the per cent of flow to be added or subtracted to or from the first assumption. The same amount added to the flow in one loop must, of course, be subtracted from the flow in the other loop. That is, the flows must be balanced to produce the same friction loss in each loop. This amount, to be added or subtracted, is known as the "correction," or per cent of correction.

The corrections are made and the friction head (h_f) for each loop is again calculated and so on, until the amount or percentage of correction is as small as is desired. How small will be determined by the degree of accuracy sought. For usual design (or a study of an existing system) a correction to anything under 1 per cent is sufficient, and this is not laborious. In the consideration of a large network it may be necessary to make from three to ten corrections before the conditions of a balanced flow are satisfied.

Professor Cross suggests that a curved arrow be drawn on the right of the values of the sum the two h_f values for each circuit with the arrows pointing from the smaller to the larger figure. Such arrows will show correctly the direction of the counterflow in the particular circuit. In the examples given with this discussion a horizontal arrow indicates the larger figure and direction of counterflow into the circuit represented.

For the simpler problems, the arrow may be omitted. For more complicated problems if one wishes to indicate the direction of the counterflow he may do so with any symbol that is preferred or understood by him.

Preliminary and Working Sketches

In the consideration of a pipe system, it is good practice to first make a diagrammatic plan. A rough pencil sketch is sufficient to begin on. It does not have to be to scale, but need only show the sizes, lengths, pipe coefficients, point of entrance and discharge, etc. Such a preliminary sketch is illustrated in Fig. 4.

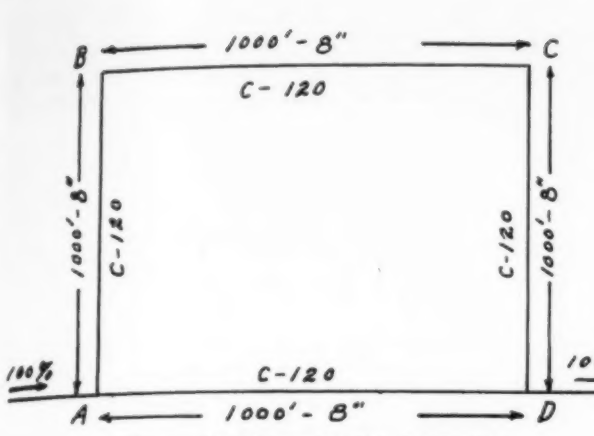


FIG. 4—PRELIMINARY SKETCH

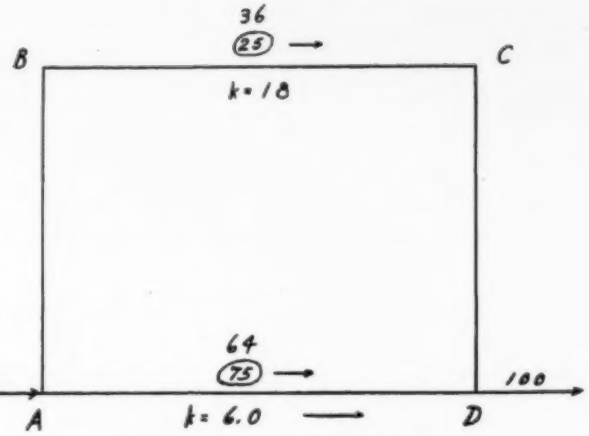


FIG. 5—WORKING SKETCH

Then a second sketch is made, which may be called the working sketch. On this is shown the quantities (percent of total flow) and the values of (k), as illustrated by Fig. 5, and the assumed direction of flow as indicated by arrows.

Illustration of Use of the Method

Refer to Fig. 5. In this case, loop ABCD consists of 3000 feet of 8″ pipe with C = 120. From Fig. 2 (the table) we find that (k) for 8″ pipe, C = 120 is 6 per 1000 feet. Therefore, k for loop ABCD is $3 \times 6 = 18$, which is recorded at a convenient point on the loop in question, as shown on the sketch. Loop AD also being 8″ pipe, C = 120, has the same k of 6 per 1000 feet and being 1000 feet in length its k is $1 \times 6 = 6$. This value is recorded on this loop A-D. In addition, 100% is shown entering at point A and leaving at point D.

The First Assumption

The quantity of flow around each loop that will produce the same friction loss in each loop is now desired.

Considering that loop ABCD is three times as long as loop AD and that there are four sides of equal length in this closed circuit, it may be logical to assume that only one fourth of the total quantity will flow around loop ABCD and three fourths will pass through "loop" AD. The first assumption will be, therefore, 25% for loop ABCD and 75% for loop AD. These assumed percentages are placed on Fig. 5.

The first assumed percentage of flow is usually shown along and near the center of the length of pipe or loop in question. If this value is found to be incorrect, it may be circled and the corrected value placed above or beside it, as for instance, 25 becomes 36 and 75 becomes 64 upon the first trial—see Fig. 5. If four trials are made in order to balance the flow, there will be three circled values and a final and correct value which will not be circled.

The Calculation

The value of $Q_m^{0.85}$ can be obtained from the table—Fig. 3. The clockwise loop ABCD is considered first.

Loop	$k \times Q_m^{0.85}$	$= kQ_m^{0.85} \times$	$Q =$	h_f
ABCD	18×15.4	$= 277.2 \times$	$25 =$	6930
AD	6×39.1	$= 234.6 \times$	$75 =$	17595←
	511.8*			10665**

*Adding the $kQ_m^{0.85}$ values = 511.8
**Subtracting the h_f values = 10665

The amount (per cent) of correction to be made is equal to the difference of h_f divided by 1.85 times the sum of the $kQ_m^{0.85}$ values.

$$\therefore \text{Correction} = \frac{10665}{1.85 \times 511.8} = \frac{10665}{946.83} = 11.26\%$$

11% should be subtracted from the assumed quantity through the loop having the greatest h_f value (loop AD) and added to the quantity through the other loop. In other words, the original assumption was 11% too much for loop AD and 11% too little for loop ABCD. For all practical purposes it is not necessary to apply the correction to the extent of using decimal fractions. That is, 11% is enough rather than actually correcting to 11.26%.

75 — 11 = 64 (corrected flow for loop AD)
25 + 11 = 36 (corrected flow for loop ABCD) (see fig. 5)

The first assumption is circled and the corrected flow shown above or beside it. Any convenient method may be used to designate the first assumption and subsequent trials or corrections, such as drawing a line through each, as it is further corrected. The values of k do not change with changes in percentage of flow, but remain constant for all quantities of flow; however, $Q_m^{0.85}$ does change with each change of flow and must be again obtained from table 3 for each correction.

Second Trial

Loop	$k \times Q_m^{0.85}$	$= kQ_m^{0.85} \times$	$Q =$	h_f
ABCD	18×21.0	$= 378 \times$	$36 =$	13610←
AD	6×34.2	$= 205 \times$	$64 =$	13110
		583 (sum)		500 (difference)

$$\therefore \text{Correction} = \frac{500}{1.85 \times 583} = \frac{500}{1080} = 0.462\%$$

Since the correction is less than 1%, the second trial proved the first correction was sufficient and brought the loops into balance. It was therefore the final trial. However, in networks consisting of several circuits, it is often necessary to make several trials and corrections before a satisfactory final result is obtained. It is evident that the method is not difficult though.

Determining Total Friction

To obtain total friction loss (S_f) from A to D we first get the average h_f of both loops.

$$\frac{13610 + 13110}{2} = 13355 \text{ (Average } h_f\text{)}$$

For a flow (Q_m) of 695 gpm the total friction loss from A to D in either loops equals—

$$\text{By formula (6)}\quad S_t = \frac{13355}{100{,}000}\ (0.01 \times 695)^{1.85}$$
$$= .1335\ (6.95)^{1.85}*$$
$$= .13355 \times 36.1*$$
$$S_t = 4.82'$$

(*Note these values obtainable from Fig. 13.)

The friction loss S_t from A to D is therefore 4.82 ft. of pressure head.

With formula (6) total friction loss (S_t) between any two points for any quantity of flow (Q_m) may be calculated without further reference to or work with the working sketch (Fig. 5). In other words, after the flows have once been balanced, total friction losses may be obtained for any possible flow by only using formula (6). No further balancing is necessary.

Proving the Method

With $Q_m = 695$ g.p.m.
36% of 695 = 250 g.p.m.
64% of 695 = 445 g.p.m.
Referring to Flow Chart (Fig. 7C—120)
With d = 8, $Q_m = 250$, S is equal to 1.625′ per 1000 feet
With d = 8, $Q_m = 445$, S is equal to 4.700′ per 1000 feet
Therefore by the Flow Chart (Hazen-Williams Tables)
S_t for loop ABCD = 3.0 × 1.625 = 4.86′
S_t for loop AD = 1.0 × 4.70 = 4.70′

$$\text{Average } S_t = \frac{4.86 + 4.70}{2} = 4.78'$$

By Hardy Cross Method, $S_t = 4.82'$
Difference = 4.82 — 4.78 = 0.04′

A System of Two Circuits

Many pipe systems to be studied will contain two circuits with at least a part of one loop being a common side to both circuits, as illustrated by Fig. 8.

In this case, the use of a combined sketch showing all data is demonstrated. It is believed that, by now, the fundamentals are so well understood that examples of the calculations will constitute sufficient explanation of the use of the method.

First Trial

Circuit M

Loop	$k \times Q_m^{0.85} = kQ_m^{0.85} \times$	$Q =$	h_f	
AB	3.6 × 27.8 = 100 ×	50 =	5000	
BE	2.4 × 7.1 = 17 ×	10 =	170	
			8330	5170
AFE	6.0 × 27.8 = 167 ×	50 =	8330	8330←
	284*			3160**

*Adding the $kQ_m^{0.85} = 284$.
**Subtracting the h_f values = 3160.

$$\text{Correction } \frac{3160}{1.85 \times 284} = 6.02$$

Circuit N

BCD	11.2 × 23 = 258 ×	40 =	10310	10310
BE	2.4 × 7.1 = 17 ×	10 =	170	
ED	5.6 × 32.4 = 181 ×	60 =	10900	11070←
	456			760

$$\text{Correction } \frac{760}{1.85 \times 456} = 0.902$$

In making this correction it should be noted that while circuit M requires a correction of 6%, circuit N requires a correction of only 1%. This means that the flow from A to B should be increased 6% but at point B this flow should be divided between BCD and BE so that the flow in BCD is increased only 1%; therefore, 1% is added to BCD and 5% is added to BE. (See Fig. 8.)

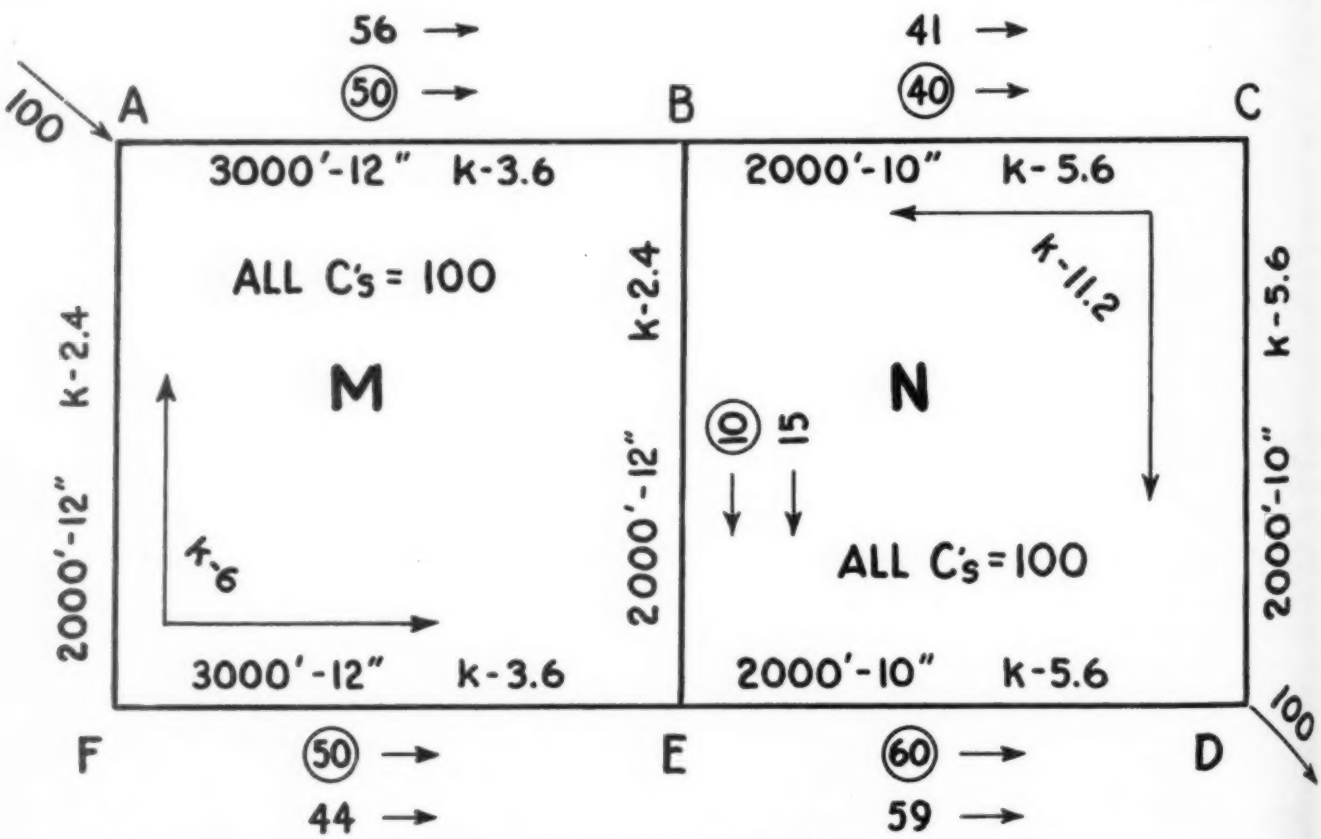


FIG. 8—A SYSTEM OF TWO CIRCUITS

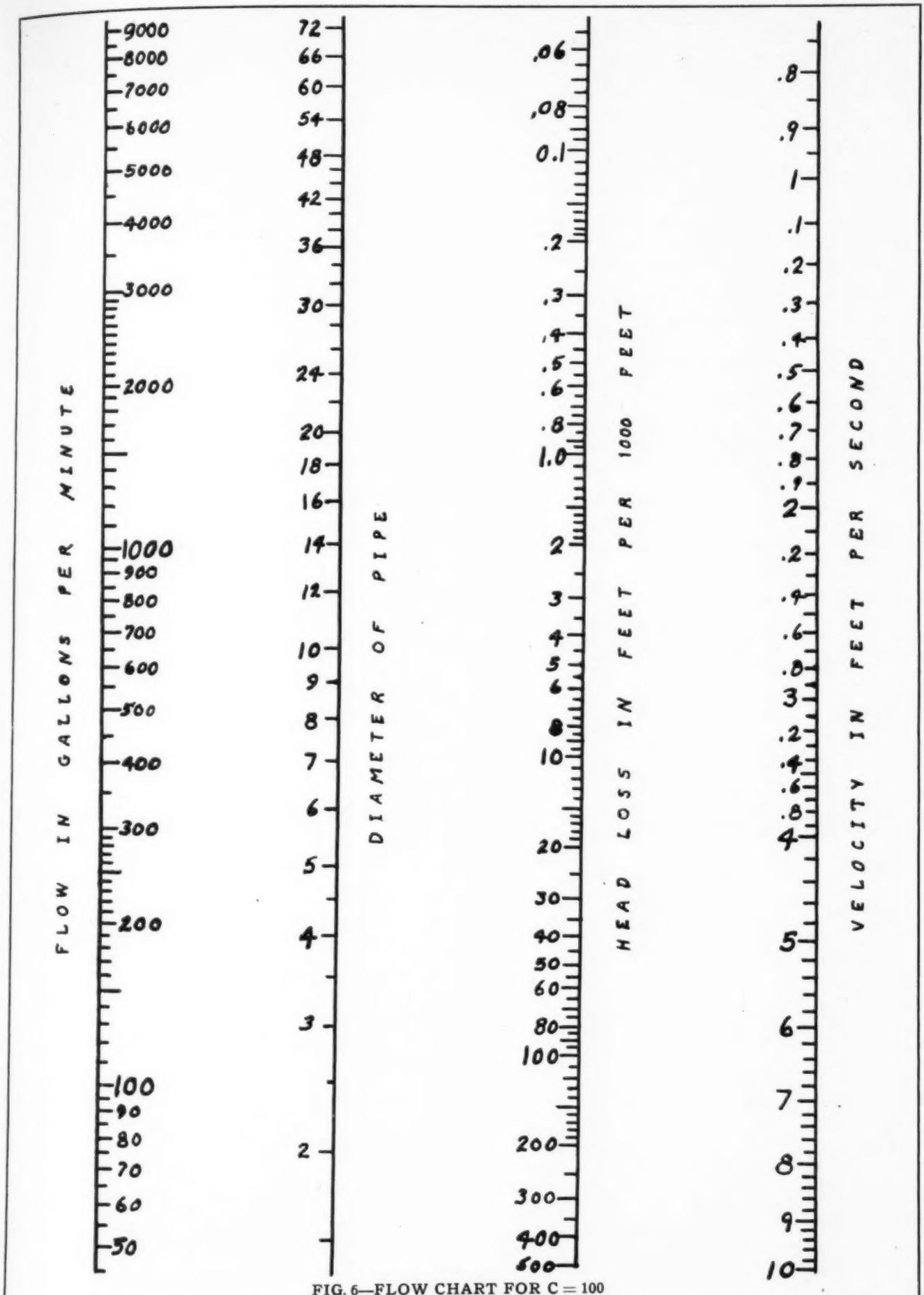


FIG. 6—FLOW CHART FOR C = 100
(Hazen and Williams Formula.)

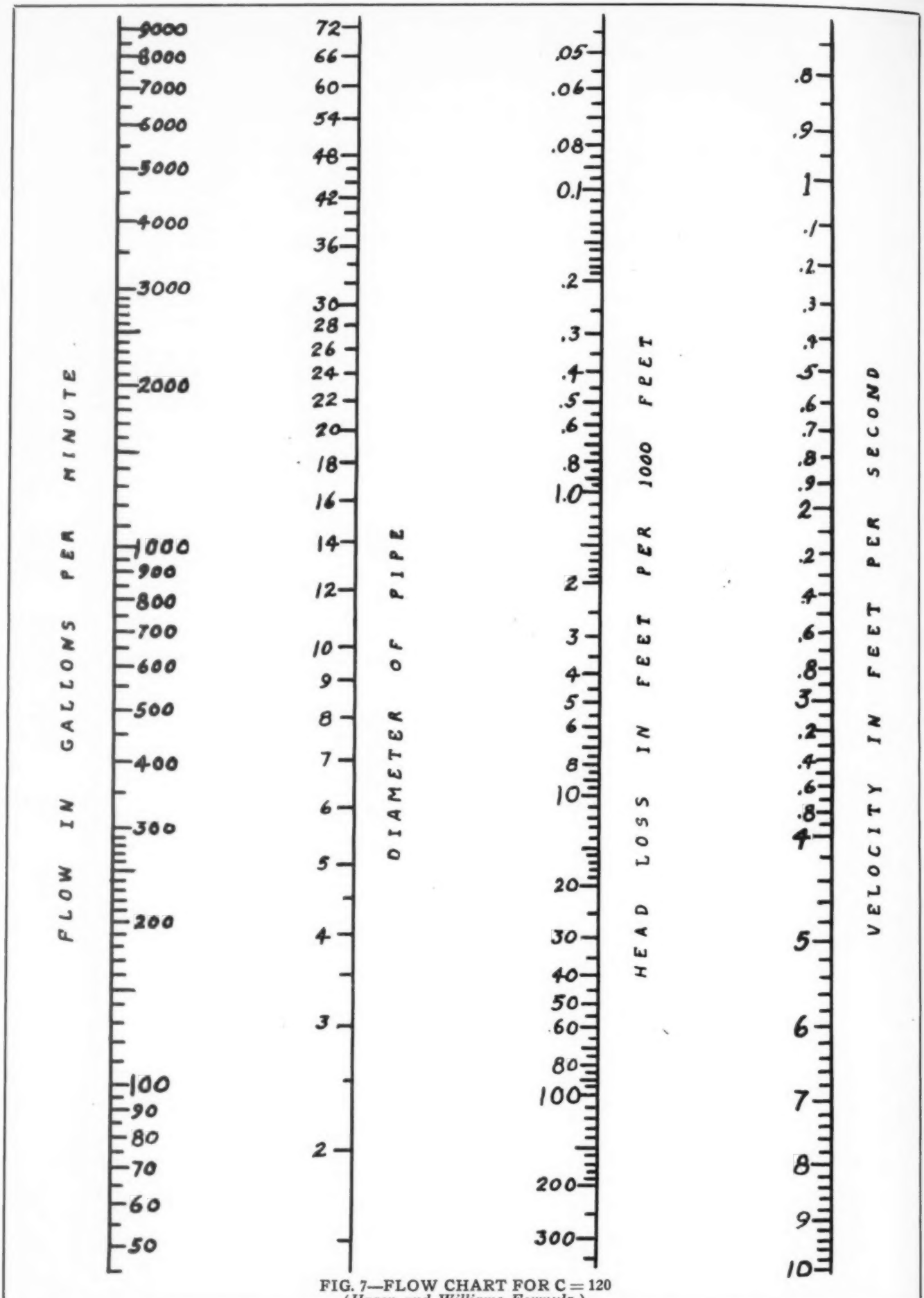


FIG. 7—FLOW CHART FOR C = 120
(Hazen and Williams Formula.)

Second Trial

Circuit M

Loop	$k \times Q_m^{0.85} = kQ_m^{0.85} \times Q_m =$	h_f	
AB	$3.6 \times 30.6 = 110 \times 56 =$	6165	
BE	$2.4 \times 10.0 = 24 \times 15 =$	360—	6525
AFE	$6.0 \times 25.0 = 150 \times 44 =$	6600—	6600←
	284		75

$$\text{Correction} = \frac{75}{1.85 \times 284} = 0.143$$

Circuit N

BCD	$11.2 \times 23.5 = 263 \times 41 =$	10800—	10800
BE	$2.4 \times 10.0 = 24 \times 15 =$	360	
ED	$5.6 \times 32.0 = 179 \times 59 =$	10560—	10920←
	466		120

$$\text{Correction} = \frac{120}{1.85 \times 466} = 0.139$$

To determine S_t from A to E for any Q_m (say 2800 gpm.)

Loop	h_f
ABE	6525
AFE	6600
	13125

$$\frac{13125}{2} = 6562 \text{ (average } h_f\text{)}$$

By formula (6)—

$$S_t \text{ (A to E)} = \frac{6562}{100{,}000} (28)^{1.85}$$
$$= 0.06562 \times 475^*$$
$$= 31.169'$$

(*From chart of $N^{1.85}$ values Fig. 13.)

To determine S_t from A to D with $Q_m = 2800$

Loop	h_f	
AB	6165	
BCD	10800	16905
AFE	6600	
ED	10560	17160
	16956 + 17160	

$$\frac{16956 + 17160}{2} = 17062 = \text{average } h_f$$

By formula (6)—

$$S_t \text{ (A to D)} = \frac{17062}{100{,}000} (28)^{1.85}$$
$$= 0.17062 \times 475^*$$
$$= 8104'$$

(*From Chart, Fig. 13)

Proving the Method

ABCD

56% of 2800 = 1570
41% of 2800 = 1148
From Flow Chart (Fig. 6-C = 100)
With d = 12, Q_m = 1570, S = 9.6′ per 1000′
With d = 10, Q_m = 1148, S = 13.0′ per 1000′

S_t (AB)	= 3.0 × 9.6 =	28.8
S_t (BCD)	= 4.0 × 13.0 =	52.0
		80.8′

∴ Total friction loss A to D by loop ABCD = 80.8 ft.

AFED

44% of 2800 = 1232
59% of 2800 = 1652
From Flow Chart (Fig. 6-C = 100)
With d = 12, Q_m = 1232, S = 6.0′ per 1000′
With d = 10, Q_m = 1652, S = 25.5′ per 1000′

S_t (AFE)	= 5.0 × 6.0 =	30.0
S_t (ED)	= 2.0 × 25.5 =	51.0
		81.0′

∴ Total friction loss A to D by loops AFED = 81 ft.

$$\text{Average } S_t \text{ (A to D)} = \frac{80.8 + 81.0}{2} = 80.9$$

S_t (A to D) by Hardy Cross Method = 81.04′
by H & W Tables (Chart) = 80.90′
Difference = 0.95′

The above constitutes all of the description necessary to show the fundamentals and the use of the Hardy Cross Method by the Doland System, sufficient for one to practically apply it in the design of a new system or to evaluate an old system. The suffix after Q has been used so far to impress the fact that the formulae herein are all based on Q in gallons per minute. In general practice several variations are used, for instance, the (%) mark, the suffixes m, f and t may be omitted after Q, h and S respectively, and the formulae (4) and (5) may be omitted above the calculations. H is preferred by some instead of h in formulae (1), (5) and (6). The designations that one cares to use are inconsequential; it is the method that is important and valuable.

The method becomes easier with each use. The third time that it is used, the time required may be less by one fourth to one third for a problem of equal size.

PART II
For Advanced Practice

For more advanced use and for the solution of more intricate problems more theory is necessary, and it might be well to present an example of a larger design problem.

$$\text{By (2) } r = \frac{S}{Q_m^{1.85}}$$

$$\text{By (3) } k = 100{,}000\ r$$

Therefore,

$$\text{(8) } k = \frac{100{,}000\ S}{Q_m^{1.85}}$$

Also

$$\text{(9) } k = \frac{1{,}064{,}000{,}000}{C^{1.85}\ d^{4.87}} \text{ (see Figure 15)}$$

or for diameter in feet (D),

$$\text{(10) } k = \frac{5860}{C^{1.85}\ D^{4.87}}$$

k varies inversely as the 4.87 power of d or D

$$\text{(11) } k_2 = k_1 \left[\frac{d_1}{d_2}\right]^{4.87}$$

To avoid confusion, sizes may be designated by a suffix as, for instance, k_6, d_8, etc.

Example: C = 120, d = 10, k = 2.0
Desired, k for d = 8

$$\text{By (11) } — k_8 = k_{10} \left[\frac{d_{10}}{d_8}\right]^{4.87}$$
$$= 2.0 \left[\frac{10}{8}\right]^{4.87}$$
$$= 2.0\ (1.25)^{4.87}$$
$$= 2.0 \times 2.962^*$$
$$= 5.93 \text{ (6.0 Fig. 2 is close enough)}$$

(*From Chart, Fig. 15.)

Figure 9 shows k for various diameters.
k varies inversely as the 1.85 power of C.

$$\text{(12) } — k_2 = k_1 \left[\frac{C_1}{C_2}\right]^{1.85}$$

Example: d = 10, C = 110, k = 2.4
Desired: k for C = 105

$$\text{By (12)— } k_2 = 2.4 \left[\frac{110}{105}\right]^{1.85}$$
$$= 2.4\ (1.0476)^{1.85}$$
$$= 2.4 \times 1.09^*$$
$$= 2.62$$

(*From Chart, Fig. 13.)

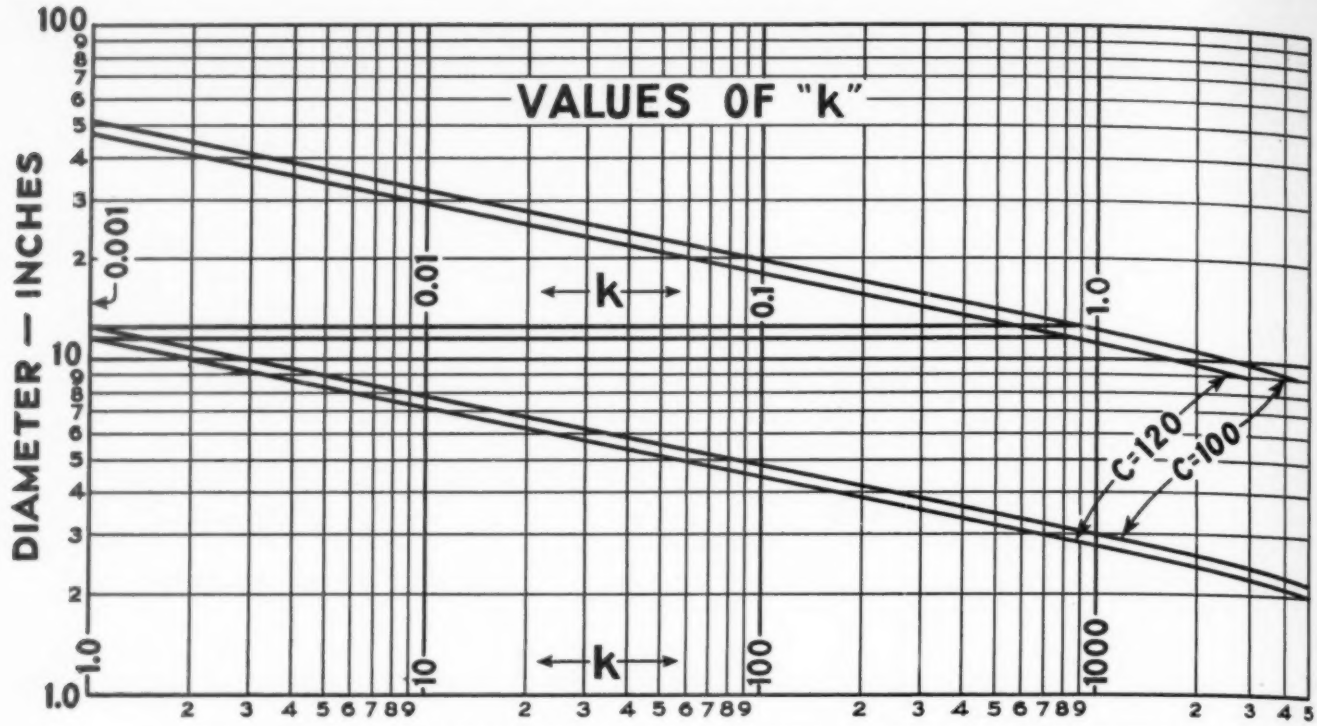


FIG. 9—VALUES OF k FOR C 100 and C 120 FOR PIPES OF VARIOUS DIAMETERS

A Practical Problem

A practical example of a design embodying most of the problems encountered in the use of the Hardy Cross Method may be described and illustrated as follows:

A suburban residential area was located at an elevation higher than that which could be served by the regular normal pressure of a city and, therefore, was served by special facilities installed at the beginning of the development when the demands were small. It had grown to proportions which demanded revamping of the system and the addition of fire protection facilities. A distribution system was designed to be used in conjunction with a 250,000 gallon tank and a booster pump of 400 gpm capacity, to be started by a float switch, when the water level in the tank dropped two feet. (See Fig. 10.) All of the old small mains were replaced with larger mains, except the 6″ main from I to K, which was paralleled with an 8″ main.

Procedure

First an equivalent diameter must be found for the 6″ main and 8″ main (paralliel) from I to K. Fig. 12 shows this equivalent diameter to be 9.26″, k for all mains except this equivalent diameter is shown in Fig. 2. For this diameter k may be found in Fig. 9 to be 2.95 (see formula 11).

To find k for two parallel mains that have different coefficients (C), that is, an old tuberculated main and a new main, the procedure is as follows:

Assume any S and determine Q for that S through the one main. Then determine Q for the same S in the other main. Then, from the flow chart, determine what size main will produce the total of the two flows (that of both mains) with the same S and with the C value which it is desired to use in the design.

The maximum domestic consumption was found to be 100 gpm and could be equally distributed between points C, E, G, J and K with a one per cent "take-off" at each of these points. Consumption at points within circuits is usually called a take-off and the quantity used at these points is designated as a percentage of the total flow into the system.

With a total flow of 2000 gpm into the system and with the pump furnishing 400 gpm, 20% would be furnished by the pump and 80% by the tank, the 80% entering the system at point B and 20% entering at I. (See Fig. 11.)

With a conflagration at point F demanding a fire flow of 1900 gpm, what will be the expected residual flow pressure at point F?

This problem embraces four features not previously shown:

1. Flow into the system is at more than one point.
2. There are parallel mains in one street.
3. The system consists of more than two circuits.
4. There are six take-offs in the system.

Example:

C for new main = 120
C for old main = 100

Desired: Equivalent diameter and k.

Flow chart for C = 100 (Fig. 6), with S = 5 feet per 1000′ shows that a 6″ main will produce a Q_m of 180 gpm. Flow chart for C = 120 (Fig. 7), with S = 5′ per 1000′ shows that an 8″ main will produce a Q_m of 460 gpm.

The total of the two $Q_m = 180 + 460 = 640$.

Q_m for the 6″ main was with C = 100 and Q_m for the 88″ main was with C = 120. It is desired to use C = 120 for all calculations; therefore, from flow chart with C = 120 it will be seen that for $Q_m = 640$ and S = 5, that d = 9.1″.

From Fig. 9, k for 9.1″ = 3.25 for C = 120 (also see formulas 11 and 12).

In this case (Figs. 10 and 11) the two parallel mains have the same C value (120) and a value of k = 2.95, which will be used.

Consideration of the Working Sketch

The working sketch (Fig. 11) shows values of k,

take-offs of 1% each at points C, E, G, J and K, 80% entering at point B, 20% entering at point I, a take-off at point F (the location of the conflagration), the values for the first assumption, the first correction and the final correction. Actually seven corrections were required to balance the flows in this system; however, only two corrections are shown. It was not deemed necessary to repeat the process seven times to demonstrate the method. The first assumption is shown within a circle, the first correction within a rectangle and the final correction not enclosed.

Attention should be called to the fact that the sum of the flows leaving a point of take-off should be equal to the flow entering this point, minus the quantity of take-off. For instance, in the first assumption, the flow from B to K is 35%. The take-off at K is 1%, therefore the flows leaving K should equal 34%, as shown. The flow from K to H being 10% and from K to J being 24%, the sum of which equals 34%. It should also be stated that it is often the case that the direction of flow in a loop is erroneously assumed, and should be reversed as well as increased or decreased; however, this is usually indicated plainly enough for immediate detection.

Computations

The computations for Fig. 11 are as follows:

First Trial

Circuit M

Loop	$k \times Q^{0.85}$	$kQ^{0.85}$	$\times Q$	$= h$	
BC	$12.0 \times 25.4 =$	304	$\times 45$	$= 13700$	
CH	$3.0 \times 10.0 =$	30	$\times 15$	$=$ 450—	14150←
BK	$12.0 \times 20.5 =$	246	$\times 35$	$=$ 8610	
KH	$5.4 \times 7.1 =$	38	$\times 10$	$=$ 380—	8990
		618			5160

$$\text{Correction } \frac{5160}{1.85 \times 618} = 4.52$$

Circuit O

CD	$2.4 \times 17.5 =$	42	$\times 29$	$=$ 1220	
DG	$3.0 \times 7.1 =$	21	$\times 10$	$=$ 210—	1430←
CH	$3.0 \times 10.0 =$	30	$\times 15$	$=$ 450	
HG	$2.4 \times 15.4 =$	37	$\times 25$	$=$ 925—	1375
		130			55

$$\text{Correction } \frac{55}{1.85 \times 130} = 0.229$$

Circuit N

KH	$5.4 \times 7.1 =$	38.0	$\times 10$	$=$ 380	
HG	$2.4 \times 15.4 =$	37.0	$\times 25$	$=$ 925—	1305←
KJ	$1.18 \times 14.9 =$	17.6	$\times 24$	$=$ 422	
JG	$5.4 \times 7.1 =$	38.0	$\times 10$	$=$ 380—	802
		130.6			503

$$\text{Correction } \frac{503}{1.85 \times 130.6} = 2.08$$

Circuit Q

DE	$4.2 \times 12.2 =$	51.2	$\times 19$	$=$ 970	
EF	$3.3 \times 11.6 =$	38.2	$\times 18$	$=$ 687—	1657
DG	$3.0 \times 7.1 =$	21	$\times 10$	$=$ 210	
GF	$3.6 \times 25.0 =$	90	$\times 44$	$=$ 3960—	4170←
		200.4			2523

$$\text{Correction } \frac{2523}{1.85 \times 200.4} = 6.78$$

Circuit P

JG	$5.4 \times 7.1 =$	38.0	$\times 10$	$=$ 380	
GF	$3.6 \times 25.0 =$	90.0	$\times 44$	$=$ 3960—	4340←
JI	$1.47 \times 8.9 =$	13.1	$\times 13$	$=$ 170	
IF	$5.7 \times 19.5 =$	111.0	$\times 33$	$=$ 3660—	3830
		252.1			510

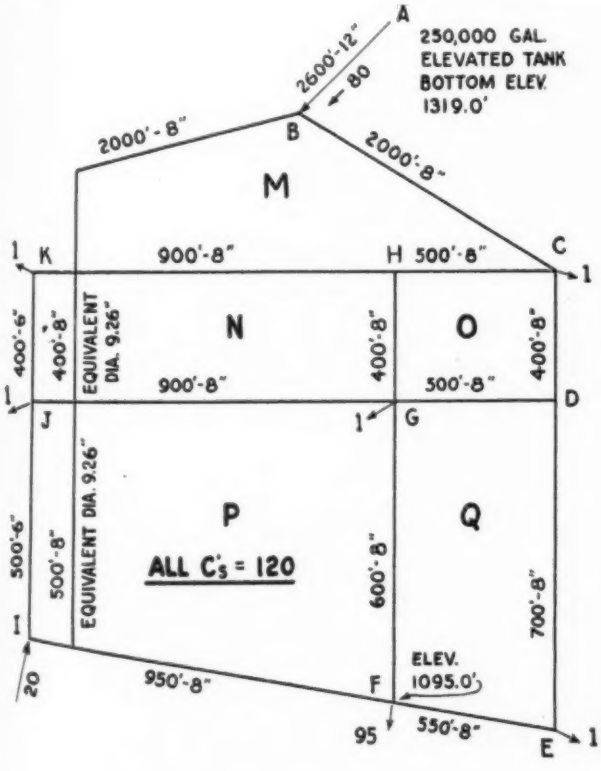


FIG. 10—PRELIMINARY SKETCH
(*For all pipes involved C is* 120.)

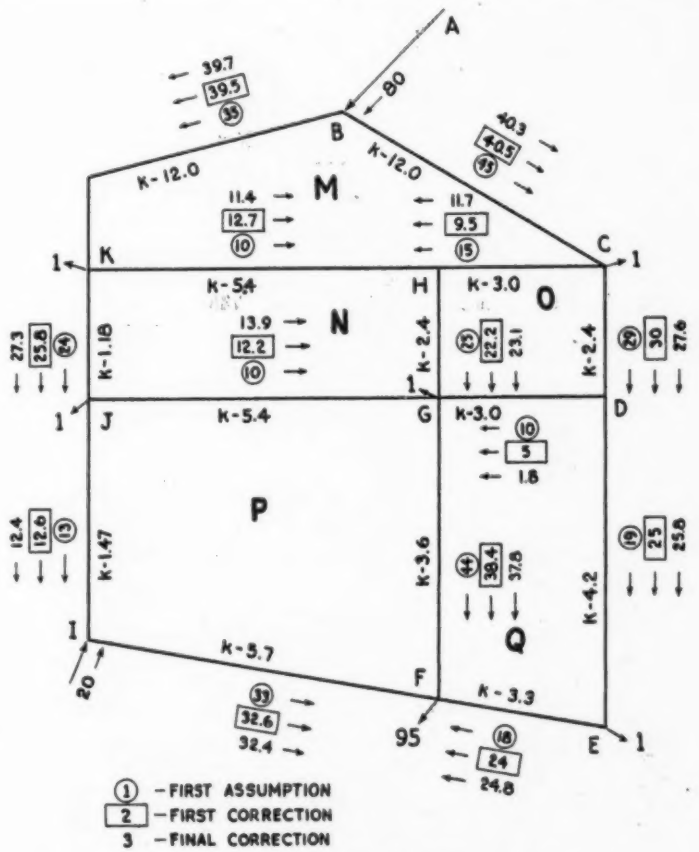


FIG. 11—WORKING SKETCH

Diameter Pipe "A"	DIAMETER OF PIPE "B"															
	2	3	4	6	8	10	12	14	16	18	20	24	30	36	42	48
2	2.6	3.36	4.14	6.13	8.08											
3		3.90	4.64	6.35	8.25	10.18										
4			5.20	6.70	8.50	10.32	12.25									
6				7.80	9.26	10.92	12.70	14.60	16.40							
8					10.40	11.82	13.42	15.52	16.80	18.80	20.70	24.50	30.50	36.25		
10						13.10	14.42	16.00	17.60	19.45	21.25	24.85	30.60	36.50	42.40	
12							15.65	17.00	18.50	20.20	21.90	25.50	31.00	36.75	42.50	48.50
14								17.25	19.50	21.20	22.70	26.00	31.50	37.20	42.80	48.75
16									20.75	22.20	23.60	26.80	32.10	37.55	43.20	49.00
18										23.45	24.75	27.75	32.80	38.10	43.70	49.40
20											26.00	28.75	33.50	38.75	44.00	49.80
24												31.30	35.50	40.30	45.50	50.85
30													39.20	43.25	47.85	52.95
36														46.90	51.00	55.60
42															54.60	58.75
48																62.50

EXAMPLE: In parallel, a 6-inch and an 8-inch main are only equivalent to one pipe 9.26-inch in diameter.

FIG. 12—EQUIVALENT DIAMETERS

$$\text{Correction} \frac{510}{1.85 \times 252.1} = 1.09$$

Second Trial (Following First Correction)

Circuit M

Loop	$k \times Q^{0.85}$	$kQ^{0.85} \times Q$	h	
BC	$12.0 \times 23.2 =$	$278.0 \times 40.5 =$	11260	
CH	$3.0 \times 6.8 =$	$20.4 \times 9.5 =$	194—	11454←
BK	$12.0 \times 22.7 =$	$273.0 \times 39.5 =$	10800	
KH	$5.4 \times 8.7 =$	$47.0 \times 12.7 =$	597—	11397
	618.4			57

$$\text{Correction} \frac{57}{1.85 \times 618.4} = 0.05$$

Circuit O

CD	$2.4 \times 18.0 =$	$43.2 \times 30 =$	1295	
DG	$3.0 \times 3.9 =$	$11.7 \times 5 =$	59—	1354←
CH	$3.0 \times 6.8 =$	$20.4 \times 9.5 =$	194	
HG	$2.4 \times 14.0 =$	$33.6 \times 22.2 =$	745—	939
	108.9			415

$$\text{Correction} \frac{415}{1.85 \times 108.9} = 2.19$$

Circuit N

KH	$5.4 \times 8.7 =$	$47.0 \times 12.7 =$	595	
HG	$2.4 \times 14.0 =$	$33.6 \times 22.2 =$	745—	1340←
KJ	$1.18 \times 15.7 =$	$18.5 \times 25.8 =$	477	
JG	$5.4 \times 8.5 =$	$45.9 \times 12.2 =$	560—	1037
	145.0			303

$$\text{Correction} \frac{303}{1.85 \times 145.0} = 1.23$$

Circuit Q

DE	$4.2 \times 15.4 =$	$64.7 \times 25 =$	1620	
EF	$3.3 \times 14.9 =$	$49.2 \times 24 =$	1180—	2800
DG	$3.0 \times 3.9 =$	$11.7 \times 5 =$	59	
GF	$3.6 \times 22.2 =$	$80.0 \times 38.4 =$	3070—	3129←
	205.6			329

$$\text{Correction} \frac{329}{1.85 \times 205.6} = 0.865$$

Circuit P

JG	$5.4 \times 8.5 =$	$49.5 \times 12.2 =$	560	
GF	$3.6 \times 22.2 =$	$80.0 \times 38.4 =$	3070—	3630
JI	$1.47 \times 8.6 =$	$12.6 \times 12.6 =$	159	
IF	$5.7 \times 19.3 =$	$110.0 \times 32.6 =$	3590—	3749←
	252.1			119

$$\text{Correction} \frac{119}{1.85 \times 252.1} = 0.255$$

Third Trial (Following Second Correction)

Circuit M

Loop	$k \times Q^{0.85}$	$kQ^{0.85} \times Q$	h	
BC	$12.0 \times 23.1 =$	$278 \times 40.3 =$	11200	
CH	$3.0 \times 8.1 =$	$24.3 \times 11.7 =$	284—	11484←
BK	$12.0 \times 22.8 =$	$274 \times 39.7 =$	10880	
KH	$5.4 \times 7.9 =$	$42.7 \times 11.4 =$	487—	11367
	619.0			117

$$\text{Correction} \frac{117}{185 \times 619} = 0.102$$

Circuit O

CD	$2.4 \times 16.7 =$	$40.0 \times 27.6 =$	1105	
DG	$3.0 \times 1.6 =$	$4.8 \times 1.8 =$	9—	1114←
CH	$3.0 \times 8.1 =$	$24.3 \times 11.7 =$	284	
HG	$2.4 \times 14.4 =$	$24.6 \times 23.1 =$	797—	1081
	93.7			33

$$\text{Correction} \frac{33}{1.85 \times 93.7} = 0.19$$

Circuit N

KH	$5.4 \times 7.9 =$	$42.7 \times 11.4 =$	487	
HG	$2.4 \times 14.4 =$	$24.6 \times 23.1 =$	797—	1284←
KJ	$1.18 \times 16.6 =$	$19.6 \times 27.3 =$	535	
JG	$5.4 \times 9.4 =$	$50.7 \times 13.9 =$	705—	1240
	135.5			44

$$\text{Correction} \frac{44}{1.85 \times 137.5} = 0.17$$

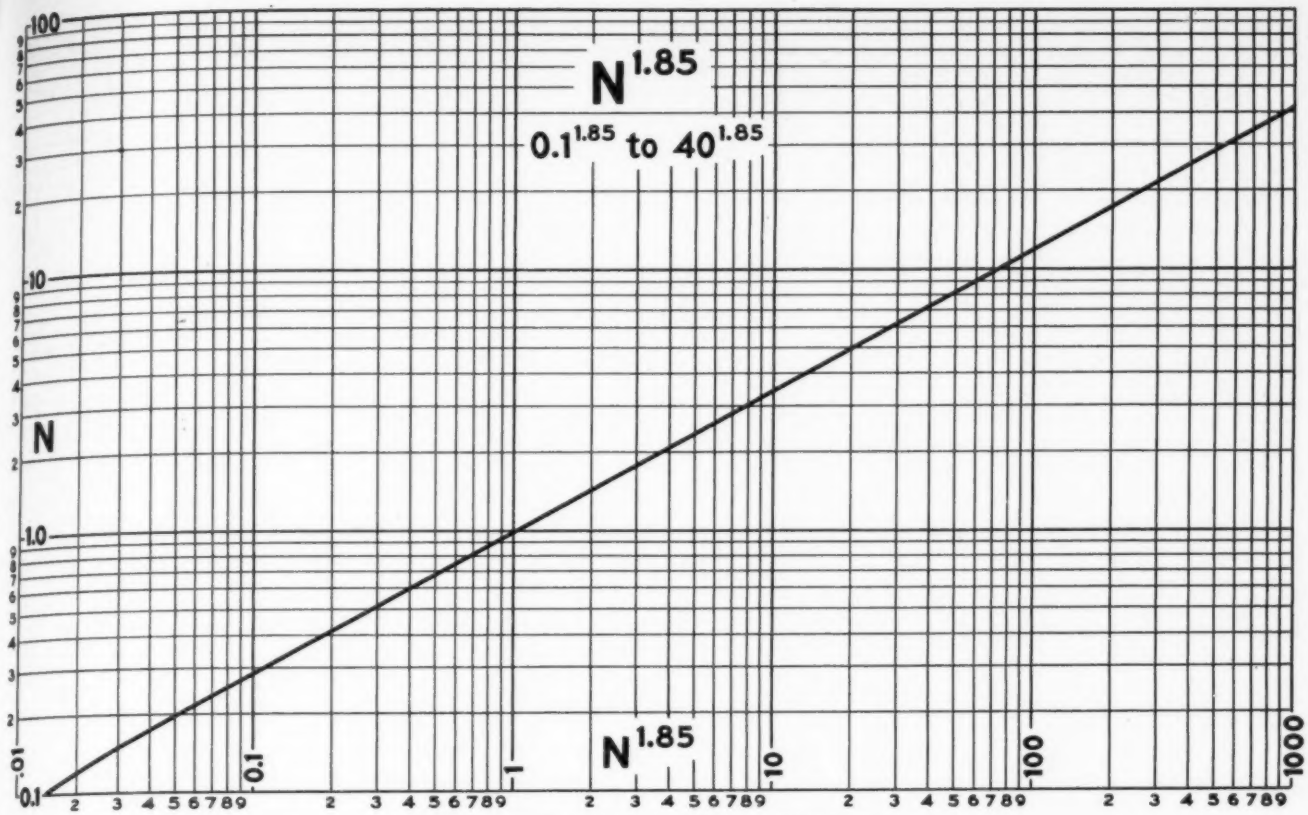


FIG. 13—THE $N^{1.85}$ POWER OF NUMBERS

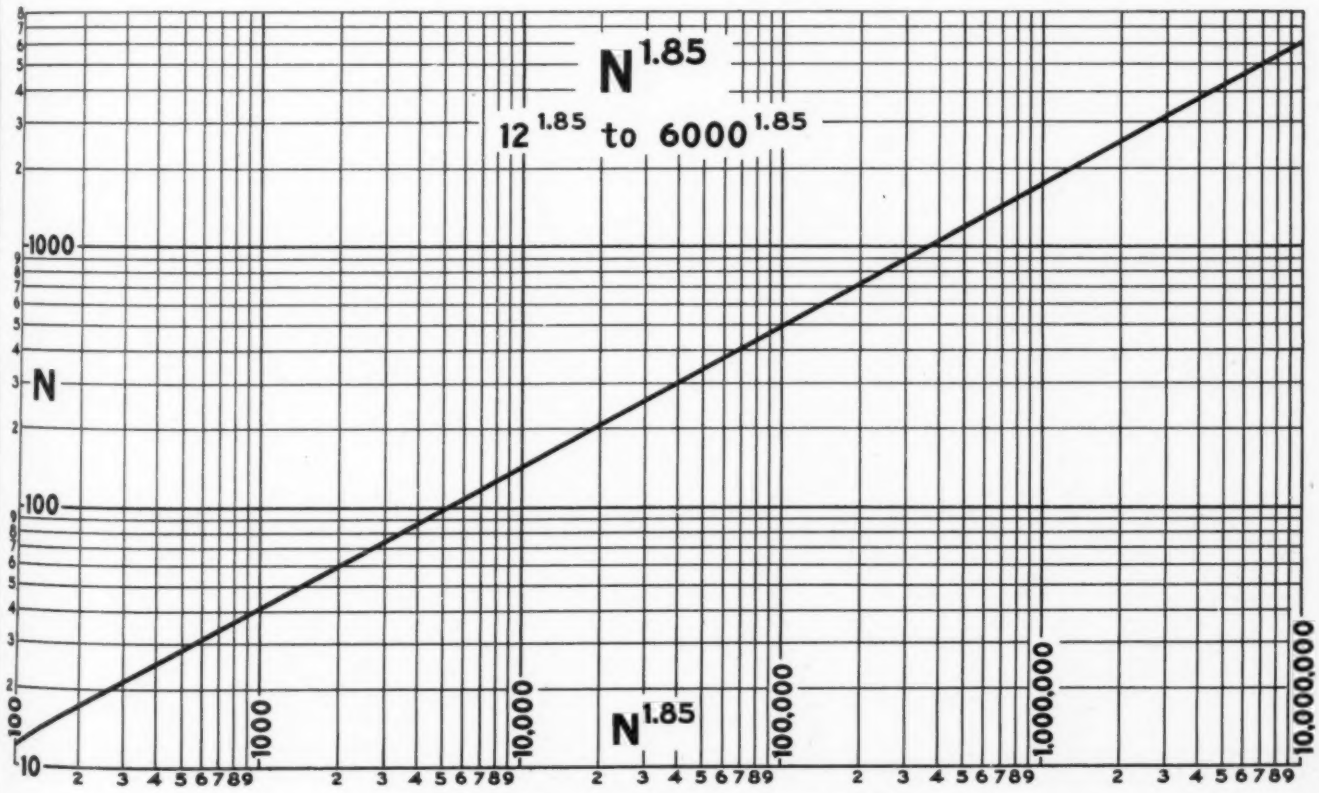


FIG. 14—THE $N^{1.85}$ POWER OF NUMBERS

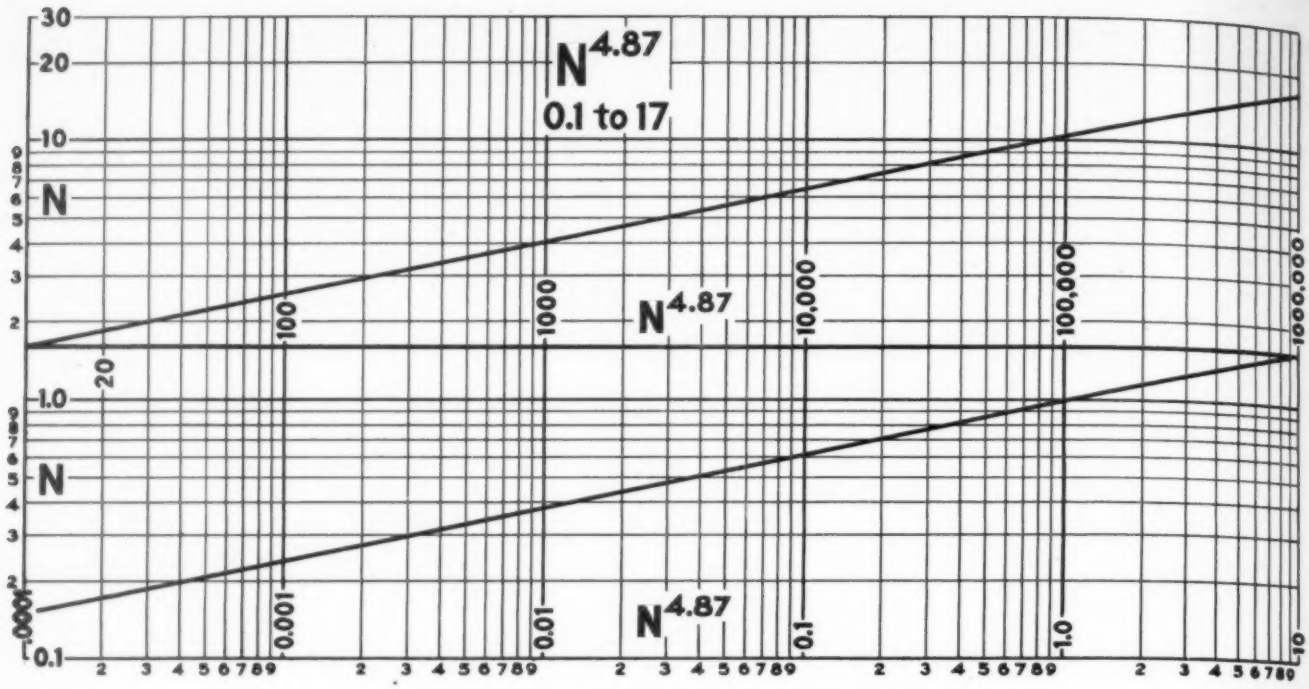


FIG. 15—THE $N^{4.87}$ POWER OF NUMBERS

Circuit Q

DE	4.2 × 15.7 =	66.0 × 25.8 =	1768	
EF	3.3 × 15.2 =	50.2 × 24.8 =	1243—	3011←
DG	3.0 × 1.6 =	4.8 × 1.8 =	9	
GF	3.6 × 21.8 =	78.4 × 37.8 =	2965—	2974
		199.4		37

$$\text{Correction } \frac{37}{1.85 \times 199.4} = 0.10$$

Circuit P

JG	5.4 × 9.4 =	50.7 × 13.9 =	705	
GF	3.6 × 21.8 =	78.4 × 37.8 =	2965—	3670
JI	1.47 × 8.5 =	12.5 × 12.4 =	155	
IF	5.7 × 19.2 =	109.5 × 32.4 =	3545—	3700←
		251.1		30

$$\text{Correction } \frac{30}{1.85 \times 251.1} = 0.064$$

This design is corrected to less than two tenths of one per cent. For usual design a correction to anything less than one per cent is ample. As a matter of fact, k for KJ could just as well have been considered as 1.2 instead of 1.18 and k for JI as 1.5 instead of 1.47 without affecting the accuracy.

Proving the Method and Residual Pressure Determination

With a total flow of 2000 gpm the total friction loss from B to F will be—

Loop	*h*	
BC	11200	
CD	1105	
DE	1768	
EF	1243	
		15316
BK	10880	
KJ	535	
JI	155	
IF	3545	
		15115
		30431

$\frac{30431}{2} = 15{,}215 =$ Average h from B to F

By formula (6)—

$$S_t \text{ (B to F)} = \frac{15215}{100{,}000} (20)^{1.85}$$
$$= 0.152 \times 254^*$$
$$= 38.6'$$

(*From Chart, Fig. 14.)

Flow from A to B = 1600 gpm

From Flow Chart (Fig. 7) for this flow through a 12″ main S = 7.0′ per 1000′, therefore S_t from A to B is—

2.6 × 7.0 = 18.2′, then
S_t (A to F) = 18.2 + 38.6 = 56.8′
Therefore, at 2000 gpm. total flow (1900 gpm. at point F) the friction loss amounts to 56.8 ft.

Elevation—bottom of tank	1319.0′
Elevation—point F	1095.0′
Total available head (H)	224.0′
Friction loss (A to F)	56.8′
Residual flow head at F	167.2′

Residual pressure (P) at F = $\frac{167.2}{2.31}$ = 72.4 psi with Q = 1900 gpm.

With a flow of 2700 gpm at F, what will be the residual pressure?

S varies as the 1.85 power of Q.

$$(13)—S_2 = S_1 \left[\frac{Q_2}{Q_1}\right]^{1.85}$$

$$\text{By (13)—} S_2 = 56.8 \left[\frac{2700}{1900}\right]^{1.85}$$
$$= 56.8\ (1.42)^{1.85}$$
$$= 56.8 \times 1.91^*$$
$$= 108.5'$$

(*From Chart, Fig. 13.)

Total available head	224.0′
S_t from A to F with Q = 2700	108.5′
Residual (flow) head—H	115.5′

Residual pressure at F with Q = 2700 = $\frac{115.5}{2.31}$ = 49.7 psi.

Considering 20 psi as the lowest residual (flow) pres-

sure permissible for good fire protection, what is the maximum safe flow possible, at this pressure, at point F?

20 psi = 20 × 2.31 = 46.2′
Total available head ..... 224.0′
20 psi ..... 46.2′

Total available head for friction loss..... 177.8′
Q varies as the 0.54 power of S (see Figure 16)
Formula (14)—

$$Q_2 = Q_1 \left[\frac{S_2}{S_1}\right]^{0.54}$$

$$\text{By (14)—} Q_2 = 1900 \left[\frac{177.8}{56.8}\right]^{0.54}$$
$$= 1900\ (3.13)^{0.54}$$
$$= 1900 \times 1.855^*$$
$$= 3520 \text{ gpm.} = \text{maximum flow with a residual pressure of 20 psi. at F.}$$

(*From Chart, Fig. 16.)

These are safe figures, because this method presupposes that the domestic take-offs of 1% at points C, E, G, J and K will also increase correspondingly; however, this will probably not be the case, hence the calculated residual pressures and flows will be slightly more than indicated, but the per cent of domestic take-off is so small, it is not necessary to lose the time required to balance the flows all over again for this increase of flow at F.

The accuracy of the above calculations in this particular case depends somewhat upon the characteristics of the pump, that is, its ability to assume its proportion of the increased flows; however, with booster pumps having a pressure head on their suction, it is reasonable to suppose that the drop in discharge heads, resulting from increased flows, will result in a proportionate increase in discharge from the pump. For extreme accuracy, a head-capacity curve of the pump in question should be used in conjunction with the design.

The Shand Nomograph

With the use of the Shand Nomograph* (Fig. 17) many calculations are obviated, thereby facilitating exceedingly the work of designing or evaluating a large system. The use of the nomograph is very simple; however, the various values are slightly rearranged.

The values of k and Q may be considered the knowns and the values of $1.85kQ^{0.85}$ and h the unknowns. Therefore, knowing k and Q, a straight edge, a transparent triangle or a transparent plastic ruler may be laid across the nomograph even with k and Q, and the values of $1.85kQ^{0.85}$ and h may be read directly where the edge of the ruler crosses these respective scales. The per cent of correction is equal to the difference of the h values of each loop divided by the sum of the values of $1.85kQ^{0.85}$.

For example, consider Fig. 5 again and the calculations made for it. The values are arranged as shown, the knowns on the left and the unknowns read from the nomograph and placed on the right.

First Trial

Loop	*k*	*Q*	$1.85kQ^{0.85}$	*h*
ABCD	18	25	525	7000
AD	6	75	440	18000←
			965	11000

$$\text{Correction} \frac{11000}{965} = 11.4$$

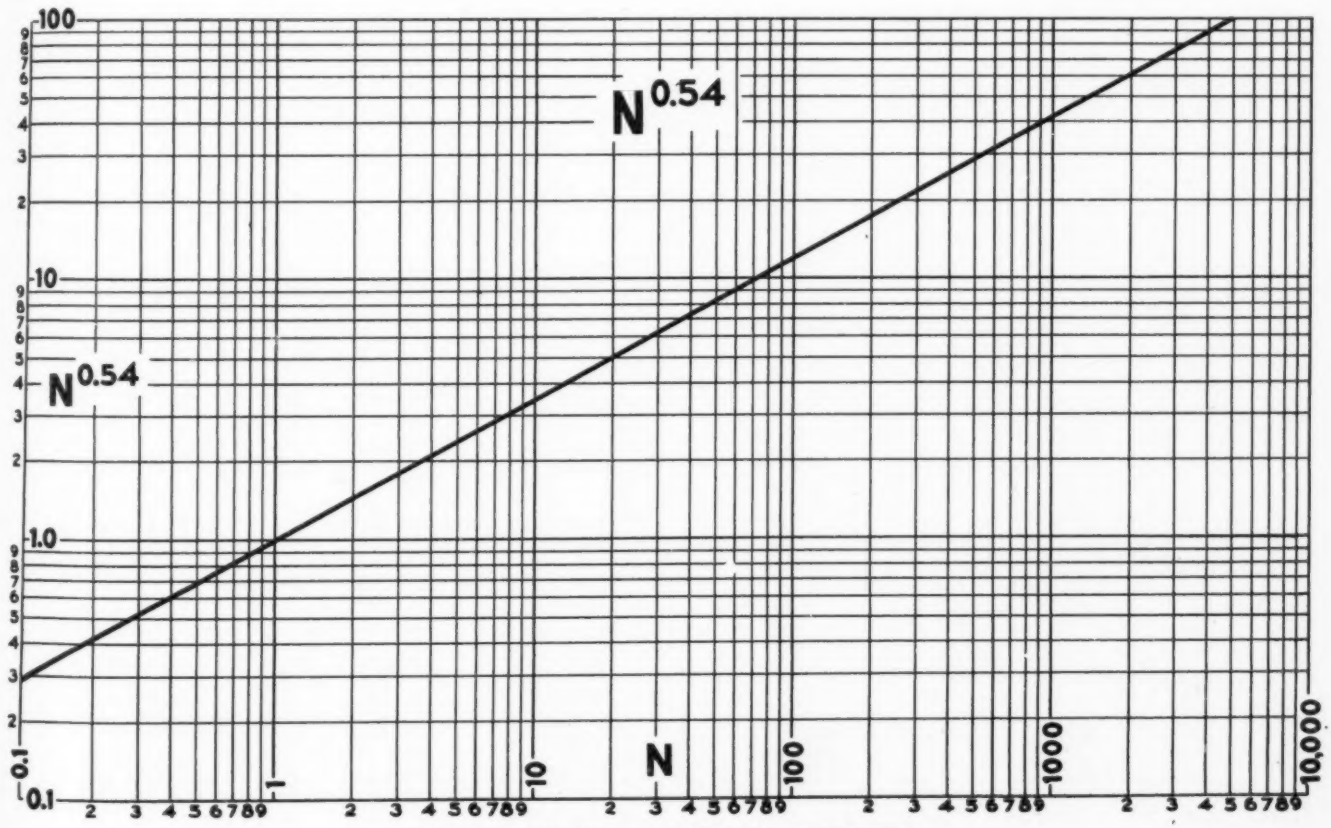
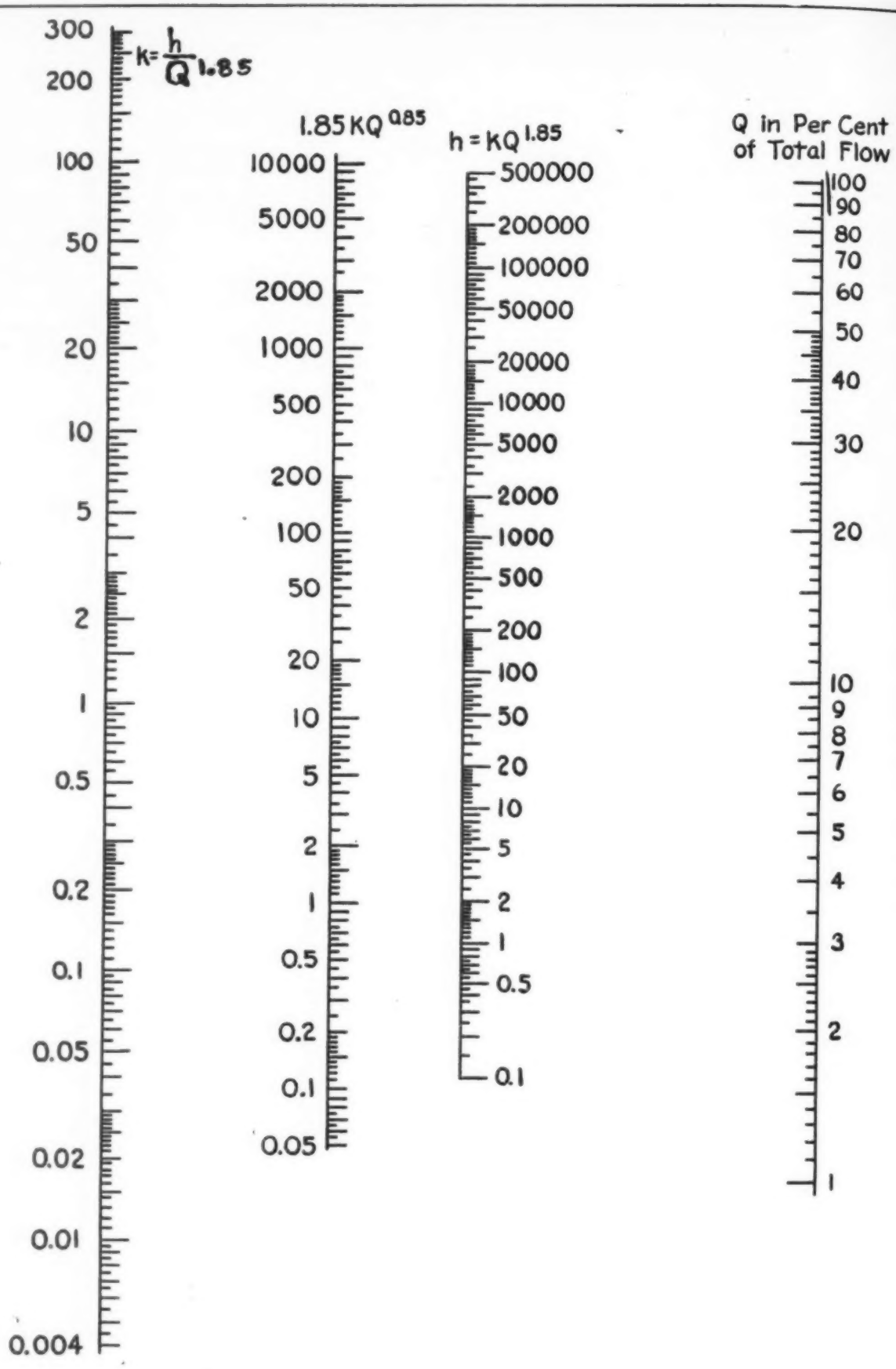


FIG. 16—THE $N^{0.54}$ POWER OF NUMBERS



SHAND NOMOGRAPH

FIG. 17—SHAND'S NOMOGRAPH FOR USE IN APPLYING THE HARDY CROSS METHOD

VALUES OF "R" FOR 1,000 FT. OF PIPE BASED ON HAZEN AND WILLIAMS FORMULA

Head Loss in Ft.: $S = r \times Q^{1.85}$ per 1,000 ft. (Q in M.G.D.)

d—Inches	c = 70	c = 80	c = 90	c = 100	c = 110	c = 120	c = 130	c = 140
4	860.69	672.31	540.67	444.91	373.00	317.53	273.83	238.76
6	119.44	93.30	75.03	61.74	51.76	44.06	38.00	33.13
8	29.42	22.98	18.48	15.21	12.75	10.85	9.36	8.16
10	9.93	7.75	6.24	5.13	4.30	3.66	3.16	2.75
12	4.08	3.19	2.57	2.11	1.77	1.51	1.30	1.13
14	1.925	1.504	1.209	0.995	0.834	0.710	0.612	0.534
16	1.007	0.787	0.633	0.521	0.437	0.372	0.320	0.279
18	0.567	0.443	0.356	0.293	0.246	0.209	0.180	0.157
20	0.3390	0.2648	0.2130	0.1753	0.1469	0.1251	0.1079	0.0941
24	0.1396	0.1091	0.0877	0.0722	0.0605	0.0515	0.0444	0.0378
30	0.0471	0.0368	0.0296	0.0244	0.0204	0.0174	0.0150	0.0151
36	0.01939	0.01514	0.01218	0.01002	0.00840	0.00715	0.00617	0.00528
42	0.00915	0.00715	0.00575	0.00473	0.00397	0.00338	0.00291	0.00254
48	0.004774	0.003729	0.002999	0.002468	0.002057	0.001761	0.001519	0.001324
60	0.001611	0.001258	0.001012	0.000833	0.000698	0.000594	0.000513	0.000447
66	0.001013	0.000791	0.000636	0.000524	0.000439	0.000374	0.000322	0.000281

FIG. 18—VALUES OF "R" FOR 1000 FT. OF PIPE (Hazen and Williams Formula)

Second Trial (Following First Correction)

Loop	*k*	*Q*	$1.85kQ^{0.85}$	*h*
ABCD	18	36	700	14000←
AD	6	64	375	13400
			1075	600

$$\text{Correction } \frac{600}{1075} = 0.56\text{—No correction}$$

*Developed by H. Shand, Engineer, Greater Winnipeg Water District, Winnipeg, Canada.

Rates in M.G.D.

For those who prefer to value flows in millions of gallons per day, Fig. 18 may be used. This table is especially useful when dealing with large mains and large rates of flow. The use of this table in balancing flows is identical with that of Fig. 2, with the exception that a different formula is used for calculating the total friction loss, and a slight difference in nomenclature.

Nomenclature and Formulas

Q_x = million gallons per day expressed as 1, 1.5, 2.6, 25, 150, etc.

(15)— $S = r\,Q_x^{1.85}$

(16)— $r = \dfrac{S}{Q_x^{1.85}}$

(17)— $S_t = h_t\ (.01\text{ M.G.D.})^{1.85}$

(18)— $S_t = r\,Q_x^{1.85}$

(19)— $a^{1.85} = a \times a^{0.85}$

(Courtesy Burns and McDonnell Engineering Co.)

Examples of Use

Consider Figs. 4 and 5. From Fig. 18, it will be found that r = 10.85 for 8″ pipe with C = 120. Therefore, r for loop ABCD = 3 × 10.85 = 32.55, and for loop AD it is 1 × 10.85 = 10.85. Using the same values in the first trial previously used when calculated on the Q_m basis, the calculations are as follows:

First Trial

Loop	$r \times Q_x^{0.85} = rQ_x^{0.85} \times Q =$	h_t
AD	$10.85 \times 39.1 = 424 \times 75 =$	31800←
ABCD	$32.55 \times 15.4 = 500 \times 25 =$	12500
	924	19300

$$\text{Correction } \frac{19300}{1.85 \times 924} = \frac{19300}{1709.4} = 11.3$$

Second Trial

ABCD	$32.55 \times 21.0 = 684 \times 36 =$	24600←
AD	$10.85 \times 34.2 = 371 \times 64 =$	23800
	1055	800

$$\text{Correction } \frac{800}{1.85 \times 1055} = \frac{800}{1950} = 0.41$$

$$\text{Average } h_t = \frac{24600 + 23800}{2} = 24200$$

For a flow of 1 million gallons per day ($Q_x = 1$), the total friction from A to D in either loop will equal,

By formula (17)—

$$S_t = 24200\ (.01)^{1.85}$$
$$= 24200 \times .000195$$
$$= 4.71 \text{ feet}$$

This value agrees with the value previously obtained for $Q_m = 695$ (one million gallons per day) shown earlier when considering Figs. 4 and 5.

For a total flow of two million gallons per day ($Q_x = 2$), total friction loss (S_t) by formula 17 will equal—

$$S_t = 24{,}200\ (.02)^{1.85}$$
$$= 24{,}200 \times .00072$$
$$= 17.42 \text{ feet}$$

Considering Figs. 4 and 5,

36% of 2 = .72 M.G.D.

64% of 2 = 1.28 M.G.D.

For loop ABCD (formula 18)

$$S_t = 32.55 \times (.72)^{1.85}$$
$$= 32.55 \times .545$$
$$= 17.73 \text{ feet}$$

This value agrees with the value obtained with formula 17 immediately preceding.

Formulas 15, 17 and 18 are easily used in connection with Fig. 3, for all numbers from 1 to 100. For instance $(25)^{1.85}$ equals 25 multiplied by $(25)^{0.85}$. From Fig. 3 we find that $(25)^{0.85}$ equals 15.4. Therefore, by (19)

$$(25)^{1.85} = 25 \times 15.4$$
$$= 358$$

Again considering Figs. 4 and 5, S_t from A to D (loop AD) equals, for $Q_x = 2$, $S_t = 10.85 \times 1.28$ (64% of 2) $\times\ (1.28)^{0.85}$

From Fig. 3, by interpolation $(1.28)^{0.85}$ equals 1.224 approximately, and

$$= 10.85 \times 1.28 \times 1.224$$
$$= 17 \text{ feet}$$

This value agrees closely enough with the two values preceding.

In conclusion it might be stated that with the use of a log and an H & W slide rule all calculations involving exponential formulae are immensely facilitated.

REFERENCES

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2. W. D. Hurst and N. S. Bubbis, "Application of the Hardy Cross Method to the Analysis of a Large Distribution System," Jour. AWWA. Vol. 34, No. 2, 1942.
3. H. E. Babbitt and J. J. Doland, "Water Supply Engineering," 1939—a text 1939.
4. H. G. Payrow, "Sanitary Engineering"—a text. 1941.
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W.P.B. to Have a Special Sewerage Section

Director Maverick of Governmental Division Makes Announcement in Special Address Before N. J. Sewage Works Association

Readers will recall having seen in our February issue certain resolutions of the Board of Directors of the Am. Society of Civil Engineers and the Executive Committee of the Sewerage Works Federation passed late in January and directed to the Honorable Maury Maverick, Director of the Governmental Division of the War Production Board. The resolutions outlined the need for the establishment of a special Section in the Governmental Division for the purpose of handling matters pertaining to sewerage and sewerage treatment.

Following this, in response to the resolution, the Director of the Governmental Division designated official representatives to further discuss the resolutions with the Secretary of A.S.C.E. As an outcome of the forthright presentation of facts and needs and their conveyance to Director Maverick by his representatives, the Director requested three men to serve as a committee of consultants to the Governmental Division for the purpose of interview and a more thorough discussion in Washington. The outcome of this discussion with director Maverick and his administrative staff the committee was requested to submit specific recommendations as to policy, plan and procedure in the possible establishment of a new Section to be devoted expressly to Sewerage and Sanitation. The committee rendered certain concrete recommendations which, after consideration by the Director of the Governmental Division and his executive staff, were accepted and approved in full. These recommendations and the Director's letter of approval, with decision to place them in effect with the least possible delay, follow.

WAR PRODUCTION BOARD
WASHINGTON, D. C.

March 8, 1943

IN REPLY REFER TO

George J. Schroepfer, President
Federation of Sewage Works Association

Linn H. Enslow, Editor
Water Works and Sewage Magazine
American Society of Civil Engineers

William Raisch, Representing
American Society of Mechanical Engineers

Gentlemen:

Your report of March 4th setting forth definite recommendations for the establishment of a Sewer and Sanitation Section within the Division of Governmental Requirements of the War Production Board is hereby acknowledged.

After further study of the benefits of this proposal, necessary steps will be undertaken to place these recommendations in effect.

The assistance and cooperation you gentlemen have rendered the Governmental Division as consultants on this important phase of our work is much appreciated, and it is my sincere desire that we continue to have the privilege of calling on you for advice and assistance.

Sincerely yours,

Maury Maverick, Director
Governmental Division

While this item is going through the presses Director Maverick is by invitation making an appearance in person before the N. J. Sewerage Works Assocation as special luncheon speaker to announce the new plans of his Division of W.P.B. in advancing its service to the sewerage and sanitation field and bettering the understanding and cooperative efforts between the governmental agency and sewerage works operators and engineers throughout the Nation.

To us, the highlight in the setting up of the new Section is that it is to be headed by and staffed with practical sewerage and sanitation men who understand the needs and also the minimum requirements necessary in maintenance and operation of plants and systems.

Recommendations Made to the Director of the Governmental Division of W.P.B. by the Special Board of Consultants on Sewage and Sanitation

Honorable Maury Maverick, Director,
Governmental Division,
War Production Board,
Washington, D. C.

Dear Sir:

Availing ourselves of the invitation to confer with you, followed by study and deliberation, the undersigned are prepared to offer for your consideration the following recommendations for strengthening the service being rendered by the Governmental Division in the field of Sewerage and Sanitation:

1. Establishment of an operating section known as the "Sewerage and Sanitation Section" in the Governmental Division.
2. Such Section to be charged with the supervision of all priorities matters relating to:
   - A. Construction of:
     - (a) Sewage and wastes collection, pumping and treatment facilities.
     - (b) Garbage and refuse collection and disposal facilities.
   - B. Alterations or additions to:
     - (a) Sewage and wastes collection, pumping and treatment facilities.
     - (b) Garbage and refuse collection and disposal facilities.
   - C. Maintenance, repairs and operation of:
     - (a) Sewage and wastes collection, pumping and treatment facilities.
     - (b) Garbage and refuse collection and disposal facilities.
3. The function of the proposed new Section would be to generally clear all matters relating to sewerage and sanitation and to determine the essentiality, in whole or part, of projects within the scope outlined under (2) above and to make recommendations to the Director of the Governmental Division as to approval or rejection of projects.
4. The method of departmental procedure under (3) would be:
   - A. For new construction, alterations and additions as outlined under (2A and B), existing organization to be utilized for processing, stripping, etc.
   - B. All matters pertaining to maintenance, repairs and operation as outlined under (2 C) and covered by Order P-141 (and allied or future amending Orders) to be administered within the proposed new Section.
5. To place these recommendations into effect, it is suggested that a Section Chief of proven administrative ability and nationally recognized in the field of sewerage and sewage treatment practice be appointed and that he be given the necessary technical assistance to carry out the objectives outlined herein.

In addition to the benefits readily apparent from the establishment of such a Section, it is our opinion that the information and data accumulated as the outcome of the functioning of the proposed Section will be of material value in sound programming of essential projects during the transition period following the successful conclusion of military hostilities.

It is confidently expected that when the above recommendations are put into effect it will be possible to even further conserve critical materials. This opinion is strengthened by our observation of the accomplishments in the water works field since the establishment of a Water Section in the Power Branch. That is to say, a closer relationship will be effected between the Federal Authority and the sewerage and sanitation officials of the Nation.

Respectfully submitted,

LINN H. ENSLOW, Consultant

GEORGE J. SCHROEPFER, Consultant

WILLIAM RAISCH, Consultant

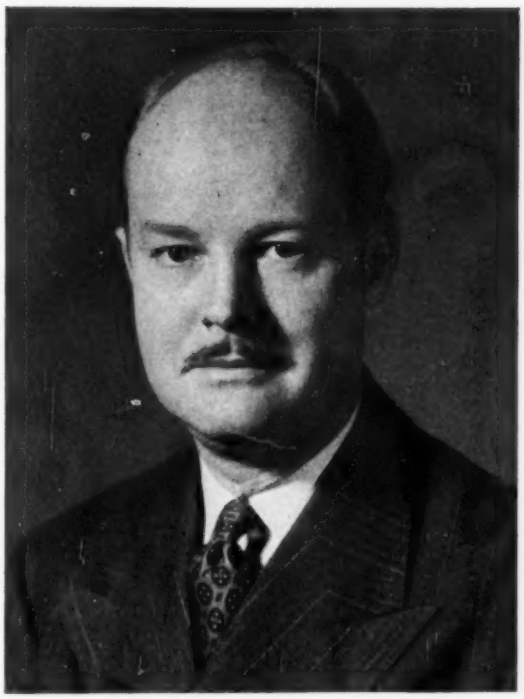
INTRODUCING OUR NEW EDITOR

George Symons Joins W. W. & S. Editorial Staff

The Gillette Publishing Company announces that on April 1, 1943, Dr. George E. Symons of Buffalo, N. Y., becomes full-time Associate Editor of WATER WORKS & SEWERAGE.

"Doc" Symons cut his professional eye teeth on the operating end of water supply under the watchful eye of a Superintendent-Dad, who still is water works "boss" down in Danville, Ill., where George was born the same year that they put in filtration—1903.

The little water fairies at Danville whispered in George's ear—"Go to college, study chemistry, and learn all about water." From a water "Super's" meager earnings his "Dad" sent George first to the University of Wisconsin and then to the University of Illinois, from which he returned home with a Bachelor of Science degree with Honors in Chemistry. He returned to the University of Illinois for graduate study in Sanitary Chemistry and Bacteriology, and when he completed his work he was the possessor of two more sheepskins for the attic trunk. The degree of Master of Science and Doctor of Philosophy were his by 1932.



George E. Symons, M.S., Ph.D.
Associate Editor

The rapid strides then being made by sewage treatment attracted the young Ph.D. away from his "first love"—WATER—and he became associated with another chemist who had earlier fallen from grace by leaving water works for sewage treatment—"Doc" Hatfield of Decatur, Ill. And, so, Symons became chemist at the Decatur, Ill., Sewage Treatment Plant, later joining the Illinois State Water Survey and doing some teaching as Instructor in Sanitary and Colloidal Chemistry in the University.

Following this he was employed by the Freeport Sulphur Co. on water treatment problems and, thereafter, conducted a consulting practice in water and sewage treatment until joining the engineering firm of Greeley and Hansen of Chicago in 1935.

When "Doc" Symons' firm undertook the design of the modern sewage treatment plant of Buffalo, N. Y., he was in 1936 placed in charge of treatment studies, conducted for the supplying of data used in plant design and for planning subsequent plant operation. Upon completion of the new plant he was retained by the Buffalo Sewer Authority as Chief Chemist, which position he has occupied from 1938 to date. During this tenure he has conducted numerous plant operating and research studies that have been productive of improved methods and plant operating economies of note.

The new Associate Editor of WATER WORKS & SEWERAGE is already known to its readers because of his worthy articles therein. Dr. Symons, a prolific producer of papers during his career, has to his credit as author or co-author 46 published papers and articles, one of which brought to him the Kenneth Allen Award of the N. Y. State Sewage Works Association.

Dr. Symons, whose name is already in "American Men of Science," is a member of the fraternity Phi Kappa Sigma and the honorary scientific and engineering societies Sigma Xi, Phi Lamba Upsilon, Mu San, and Alpha Chi Sigma. He is a member of the American Society of Civil Engineers, having served as secretary of the Buffalo Section; of the American Institute of Chemical Engineers, serving as secretary of the Western N. Y. Section; the American Chemical Society; the American Water Works Association; the Federation of Sewage Works Association through the N. Y. State Sewage Works Association, of which he is a member of the Executive Committee, Chairman of the Program Committee and Research Committee, and Chairman of its Western Section, of which he was an organizer and energizing secretary for several years. Continuing his interest in water, he was chosen Chairman of the Erie-Niagara Water Operators Conference, sponsored by the A.W.W.A.

"Doc" Symons, with his rich background of teaching, investigational, consulting and operating experience in water supply and sewerage, and his proven ability in expressing himself in words and print, constitutes what we believe to be a real "find" in our search for a well qualified Associate Editor.

"The Ominous Arms Case"—A New Back-Siphonage Sound Movie

In N. Y. State Dept. of *"Health News" the* following notice has appeared. Knowing that many of our readers may have use now or in the future for a movie picturizing the workings of and dangers from back-siphonage and measures of correction, we are reproducing this notice in part:

The dangers of back-siphonage of sewage into the water supplies of buildings are dramatized in a recently produced sound motion picture, "The Ominous Arms Case," based on a suit for damages which was brought against the owner of an apartment house when the child became ill from a water-borne disease.

It illustrates approved types of modern plumbing fixtures and the need for employment of well-informed plumbers. Bookings of this sound film in the 16 mm. size may be arranged through the Office of the War Training Programs, 353 Broadway, Albany, N. Y.

"CALL MEN"

Their Education and Preparation for Anticipated Calls*

By EVERETT O. BOOTHBY
Ass't Supt.
PORTLAND WATER DISTRICT
PORTLAND, MAINE

The Author

THE responsibility of maintaining water service in case of an air rail falls on the water utility itself.

In peace time the Portland Water District System is sufficiently manned to handle any emergency, but in war time the force is not sufficient to spread itself over the whole territory during bombings. This made it necessary to enlist competent men from the outside to help fill in the emergency organization. The Portland Water District asked plumbers, steam fitters and others who are somewhat familiar with the operation of water gates and the repairing of cast iron pipe to help them in the capacity of gatemen or Zone Men. The response was very gratifying.

Before these men could be instructed in their duties, much planning and work was necessary.

The Zone Plan

The idea of using the city wards or Civilian Defense Zones did not seem practical, so the Portland Water District divided its territory into zones according to the size of mains, congestion of buildings, importance of defense industries and vulnerable spots such as water fronts and shipyards.

The District contains approximately 3,500 gates controlling about 460 miles of mains. This territory has been divided into 33 zones, with an average of about 100 gates per zone.

The following shows the average number of feet of mines controlled by one gate—

	Feet
Portland (city proper)	380
Suburban Areas	610
Village Districts	860
Rural Districts	1,200

Also, the gates and gate books had to be prepared for the Zone Men. All gates were inspected and location measurements rechecked. Copies of the gate books were made and distributed, each Zone Man having a map of his own territory. As far as possible the Zone Man was assigned to the zone in which he lived.

Training

Then, each zone man should familiarize himself so thoroughly with the location of his gates that he can put his foot on any of them in a blackout. To accomplish this, each zone man was taken out by one of our men to show him the location of the gates, tell him their size, show him how to operate them, and what gates to shut off in order to close certain sections. Some of the Zone Men have been out several times and others, very few. This Spring we will start again on their education and expect to have an efficient group of men to help us if the occasion arises.

A P.W.D. "Call Man"—READY

The Zone Man's Equipage

The Zone Man wears a white steel helmet with the word "Water" painted in black on the front. He will be provided with an arm band showing that he belongs to a Utility Repair Crew, and will have a certificate from the State Coordinator.

His equipment consists of a knapsack containing his gate book, flashlight, a 100-foot tape, and of course the proverbial gate wrench, a pick and shovel.

Operations

In case of an air raid, all Zone Men are expected to report to their nearest O.C.D. Precinct Headquarters on the first warning. There are 25 of these stations.

As the Air Raid Wardens bring in reports of damage to water mains our Zone Men will investigate and handle all minor troubles. If he needs help, the Precinct Headquarters will telephone or send a messenger to the Control Center where our representative will communicate with the shop and one of the regular crews stationed there will be sent to his assistance.

After the raid, all Zone Men without incidents will report by telephone to the shop to see if they are needed elsewhere.

Zone Men who have had minor incidents are expected to report those to the shop immediately.

We hope that Hitler will be kept busy at home but in case he should visit us with airplanes, the Portland Water District will be greatly assisted by these Zone Men in shutting off broken mains and getting damaged sections back to normal again.

*A paper presented before the Maine Water Utilities Association, Portland, Me., Feb. 9, 1943.

THREE CHICAGO FEATURES FOR YOUR POST-WAR SEWAGE PLANS

1—Specialized Equipment
2—Application Engineering
3—Supervision of Installation and Operation

SPECIALIZED EQUIPMENT developed by the Chicago Pump Co. for the Activated Sludge Process, and for automatic, trouble-free handling of sewage in all types of plants includes the following:

CHICAGO WIDE-BAND AIR DIFFUSION SYSTEMS with Swing Diffusers and Stationary Diffusers for medium and large plants.

COMBINATION AERATOR-CLARIFIER, which performs the aeration and clarification phases of the Activated Sludge Process in a single tank, is ideal for small plants.

COMMINUTOR for subsurface, automatic screening and cutting of coarse solids without removal from sewage channel.

FLUSH-KLEEN sewage pumps for lift stations are automatic and cannot clog, because solids do not pass through the impellers.

SCRU-PELLER, designed especially for primary sludge, has multiple shearing action all the way through the pump.

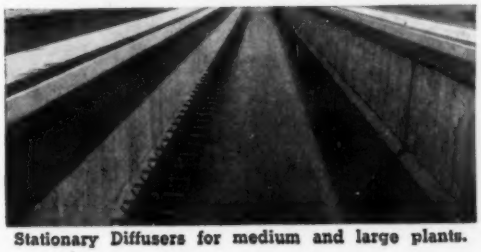
APPLICATION ENGINEERING, based on ten years' experience, includes complete preliminary reports in connection with the rational application of equipment for the successful operation of Activated Sludge Plants. Reports include cost and operation estimates and schematic layouts.

SUPERVISION OF INSTALLATION AND OPERATION insures successful operation of plants and equipment.

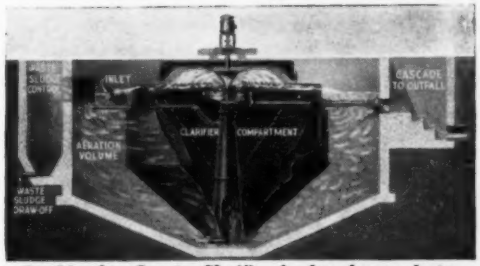
OUR DISTRICT SANITARY ENGINEERS WILL CONFER WITH YOU

Our District Sanitary Engineers are busy with war projects, but they can be scheduled to review your post-war problems with you when in your vicinity. Write today and we shall be glad to call on you.

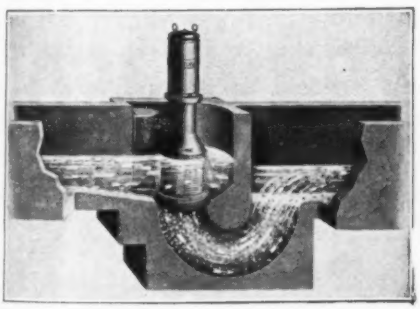
Swing Diffusers for medium and large plants.



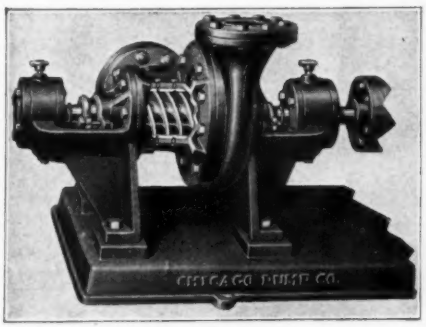
Stationary Diffusers for medium and large plants.



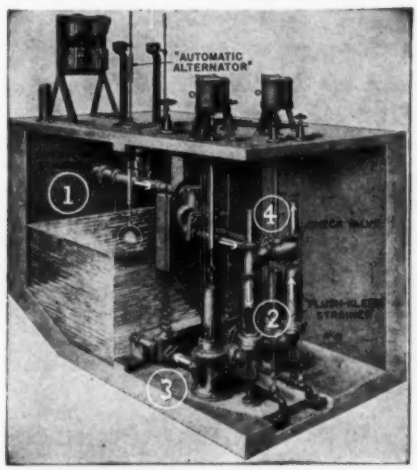
Combination Aerator-Clarifier for housing projects, small camps, institutions and small towns.



COMMINUTOR
Automatic Screening and Cutting of All Coarse Sewage Matter.



SCRU-PELLER
Centrifugal Pump With Cutting Screw Feed.



FLUSH-KLEENS can't clog. Solids do not pass through the impellers.

① Sewage flows through inlet pipe.
② Coarse sewage matter is retained by strainer.
③ Strained sewage flows through idle pump to basin.
④ Special check valve closes; sewage and coarse matter are pumped to sewers.

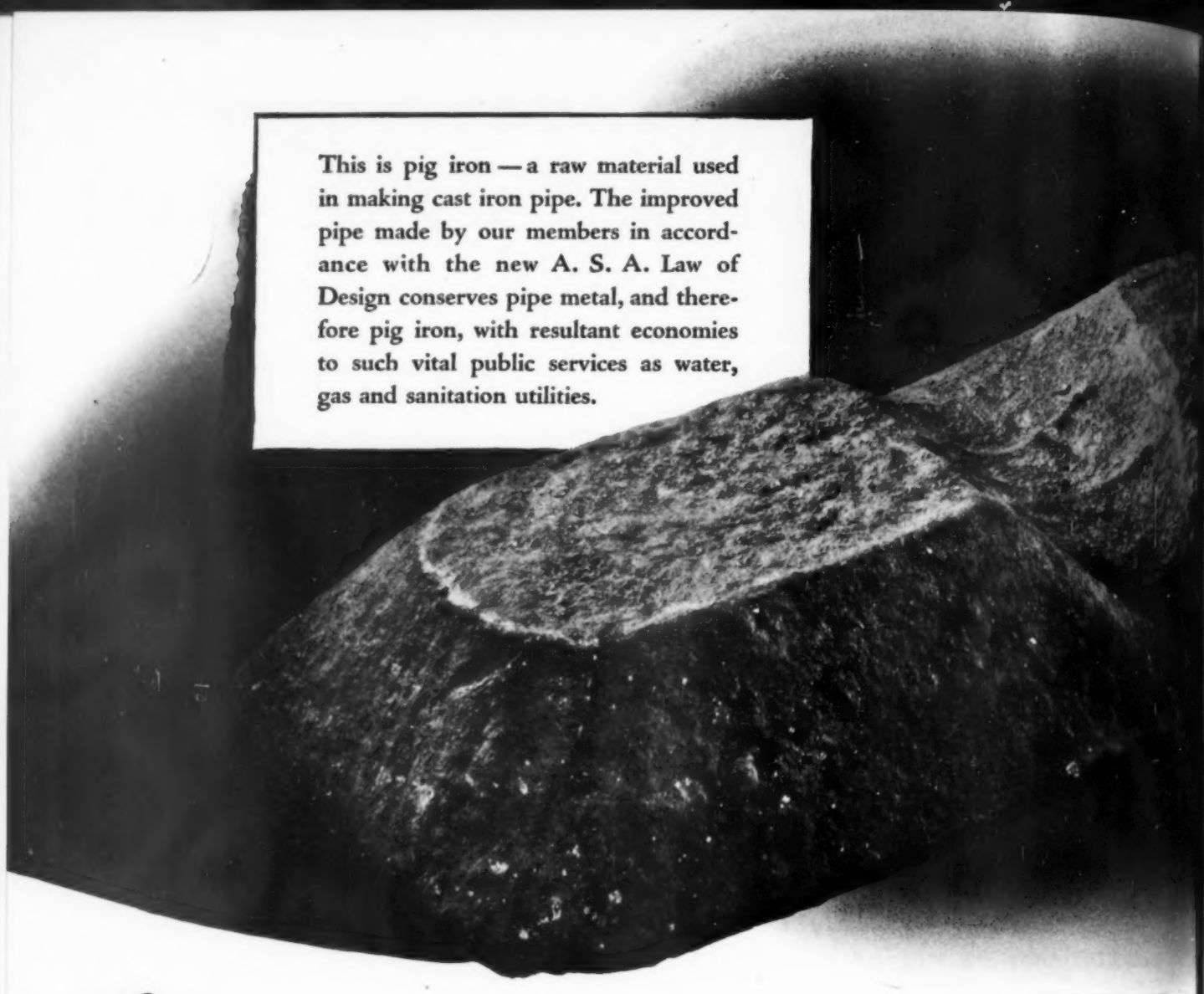
CHICAGO PUMP COMPANY

SEWAGE EQUIPMENT DIVISION

2300 WOLFRAM STREET — **CHICAGO, ILLINOIS**

Electric Pumps: Circulating, Bilge, Scru-Peller, Flush-Kleen, Plunger, Fire, House, Condensation, Vacuum.

Swing Diffusers, Stationary Diffusers, Mechanical Aerators, Combination Aerator-Clarifiers, Comminutors.

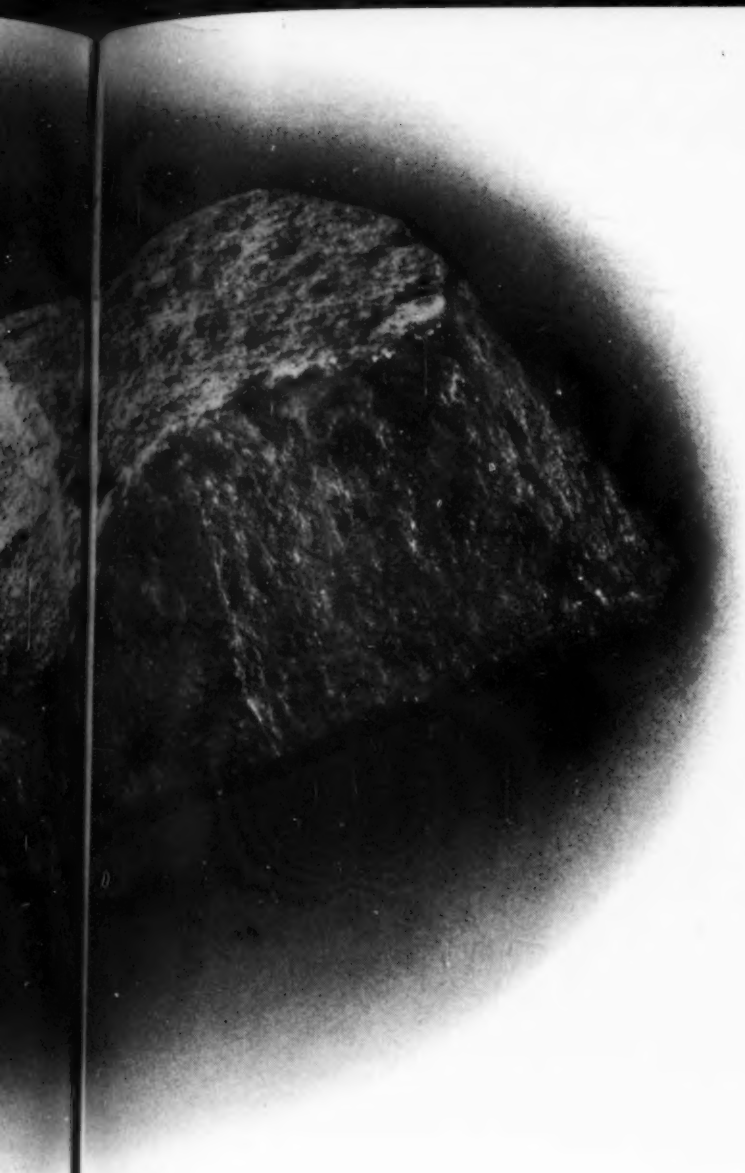


This is pig iron — a raw material used in making cast iron pipe. The improved pipe made by our members in accordance with the new A. S. A. Law of Design conserves pipe metal, and therefore pig iron, with resultant economies to such vital public services as water, gas and sanitation utilities.

Now CAST IRON PIPE BECOMES EVEN *more* ECONOMICAL

Yes, cast iron pipe, by far the lowest in cost per service year of all pipe materials used for underground mains, is now more economical than ever.

In January we announced that our members were making pipe in accordance with the recently adopted A. S. A. LAW OF DESIGN for cast iron pipe in underground service. And that this new Law of Design was the result of our cooperative study with consulting engineers and pipe users under the auspices of the American Standards Association.



This new A. S. A. Law of Design means that the weights and thicknesses of cast iron pipe are *scientifically designed for specific laying conditions.* No more risk of under-guessing. No more over-guessing to be safe. You get the proper thickness for the service required.

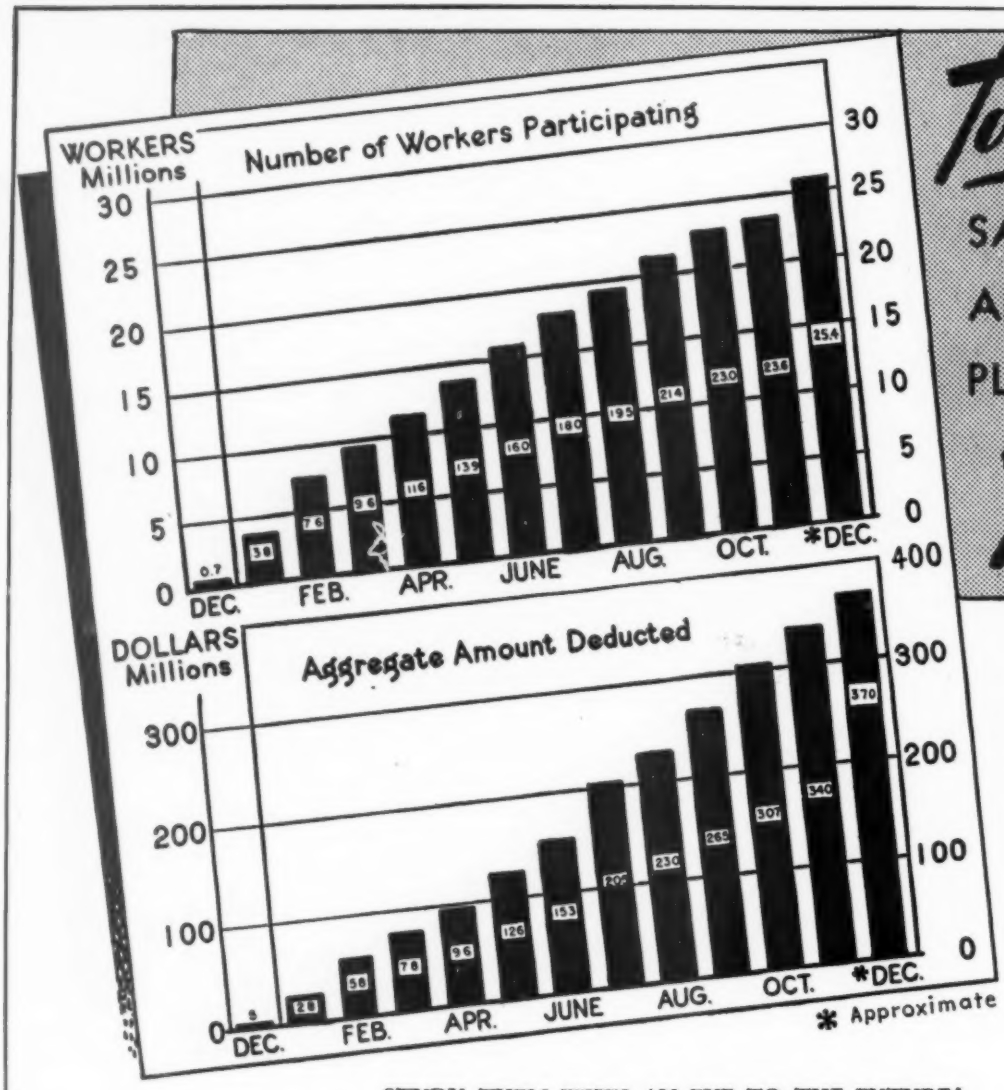
Our members will of course continue to manufacture cast iron pipe in accordance with previously established specifications—A. W. W. A.—A. G. A.—Federal Government WW—P—421. But it will be obvious that the new factors in cast iron pipe design can save thousands of tons of metal with resultant large economies to pipe users.

Thus, cast iron pipe keeps in step with American Industry's swift wartime progress in design and production. Known for *longest life* by official records—proved to be *lowest in maintenance cost* by a nation-wide survey—*salvaged or re-used* by hundreds of cities—it is now scientifically designed for specific laying conditions. And it is more economical than ever. Cast Iron Pipe Research Association, Thomas F. Wolfe, Engineer, Peoples Gas Bldg., Chicago.

RESEARCH ASSOCIATION, CHICAGO

CAST IRON

NO. 1 TAX SAVER



Tomorrow's SALES CURVES ARE BEING PLOTTED . . . Today

THESE CHARTS SHOW ESTIMATED PARTICIPATION IN PAYROLL SAVINGS PLANS FOR WAR SAVINGS BONDS *(Members of Armed Forces Included Starting August 1942)*

STUDY THEM WITH AN EYE TO THE FUTURE!

There is more to these charts than meets the eye. Not seen, but clearly projected into the future, is the sales curve of tomorrow. Here is the thrilling story of over 25,000,000 American workers who are today voluntarily saving close to FOUR AND A HALF BILLION DOLLARS per year in War Bonds through the Payroll Savings Plan.

Think what this money will buy in the way of guns and tanks and planes for Victory today—*and mountains of brand new consumer goods tomorrow.* Remember, too, that War Bond money grows in value every year it is saved, until at maturity it returns $4 for every $3 invested!

Here indeed is a solid foundation for the peace-time business that will follow victory. At the same time, it is a real tribute to the voluntary American way of meeting emergencies that has seen us through every crisis in our history.

But there is still more to be done. As our armed forces continue to press the attack in all quarters of the globe, as war costs mount, so must the record of our savings keep pace.

Clearly, on charts like these, tomorrow's Victory —*and tomorrow's sales curves*—are being plotted today by 50,000,000 Americans who now hold WAR BONDS.

EVERYBODY EVERY PAYDAY AT LEAST 10%

Save with War Savings Bonds

This space is a contribution to America's all-out war effort by

WATER WORKS & SEWERAGE

MAINE WATER WORKS ASS'N

Meets for 14th Year as Guests of the Portland Water District; Hear All-Out War Program

THE eighteen-year old Maine Water Utilities Association met in Portland, Me., February 9th and 10th for its 14th consecutive annual meeting, as guests of the Portland Water District in its handsome

Fred J. Reny
Gen'l Manager
P.W.D.
Annual Host

J. W. Randlett
Supt. of Water
Richmond, Me.
Presiding

Maintenance Building. Here technical sessions, demonstrations, equipment exhibits and meals can all be held under one roof with field demonstrations stored in the spacious yard.

As has been the custom for the past several years, the annual Portland meeting started with one of those now famed clam chowder suppers served by the women-folk of Portland Water District employees, and presided over by Fred J. Reny, P.W.D.'s genial go-getting General Manager, as No. 1 host. Modest entertainment followed the supper, which as far as this reporter is concerned features that superb "P.W.D." clam chowder and a brand of doughnuts of which there is thought to be no equal.

In these times the natural question was how did our hosts get together the scarce coffee, butter, sugar etc., required to serve the more than 100 members and guests. This question was answered by host Reny, who explained that P.W.D. employees had contributed from the family larders for the occasion these "critical materials" having been stored in the P.W.D. vault alongside of gilt edge securities and the like.

Following the hour of entertainment by local talent, what may be termed the "P.W.D. Technical Program" got under way. The lead-off man was J. Arthur Jackson, Ass't. Treasurer of the District, who spoke on "Civilian Defense in the Water Plant," in which he discussed camouflage, "strategy, tactics and operations." "Strategy," he said, was the planning and charting; "Tactics," the training of auxiliaries and machinery protection; "Operations," the provision of manpower for emergencies and plant preparation for expected attack. He had benefited by attending the O.C.D. School held at Amherst, Mass., where amongst other things it had been learned that sand smothering for incendiary bombs had been ruled out as the acceptable method, since such bombs now are made to produce a delayed explosion.

Then followed two illustrated papers. The first was by Everett O. Boothby, P.W.D.'s Ass't. Sup't, "The Education and Training of Call-Men and Preparations for Anticipated Emergencies," and the second by C. Raymond Moore, P.W.D.'s Ass't. Engr., on "Field Chlorination —Routine and Emergency." Both of

*Horace J. Cook**
Supt. of Water
Auburn, Me.
Defense Committee Chairman

J. Elliott Hale
State San. Engr.
Augusta, Me.
State Water Coordinator

*(*Illness caused him for the first time to miss attending a M.W.U.A. meeting in the 18 years since the association was organized in 1925. Considering the fact that the association holds at least six meetings each year, this record is the more impressive.)*

these timely papers are to be found printed in full in this issue.

Exhibits and Demonstrations

As is customary at these annual Portland meetings the forenoon of the following day was devoted to inspection of manufacturers' exhibits (arranged at no expense to the exhibitors) and demonstrations in shop and field. Incidentally, this arrangement offers splendid opportunity for "visiting" amongst fellow operators while also learning of the newest aids to operators and methods.

Appropriately the "Field Chlorination Crew" of P.W.D. put on a demonstration of main chlorination under Messrs. Moore's and Scales' supervision, to show at first hand

Earle A. Tarr
Supt. of Water
Winthrop, Me.
Secy.-Treas.

S. S. Anthony
Supt. of Water
Augusta, Me.
Editor

what had been discussed the evening before.

The second demonstration was that of the Boveé Los Angeles "War Gas Detector" which was, described in an article by Clifton Boveé, Research Chemist of the Los Angeles Bureau of Water Supply, in the December, 1942, issue of WATER WORKS AND SEWERAGE. (If any reader who has not a copy of this issue, desires one we will attempt to meet requests for it as long as the reserve supply of copies permits.—Ed.) This interesting demonstration was made by Jos. W. Fuller, Maine Dep't. of Health Chemist, who had the "real stuff" on hand for the demonstration of the various color changes of the indicator solutions as set forth in Mr. Boveé's article. So much interest was shown in this demonstration that Mr. Fuller was prevailed upon to repeat it at the afternoon session. He reported that the very simple assembly of tubes required for the small portable unit (see pictures) could be made at the cost of roughly $5.00 per unit. Fortunately all of the reagent solutions required were stable and therefore would remain dependable without frequent renewals.

In reply to questions Mr. Fuller stated that its use was more or less fool-proof and the indicators very sensitive to Lewisite and mustard-gas almost instantly. In the field, suction to operate it could be obtained from the automobile windshield

wiper. Although hydrogen sulphide or sulphur dioxide in industrial areas might give a false indication, the unit would only be used after or during an air raid, so that was not a factor of consequence.

Fred Sparks Wins Free Dinner; Cook Misses First Meeting

When Secretary Earle Tarr reported that in the face of transportation difficulties the attendance representing 36 separate water utilities, was 116, he named Fred Sparks, Sup't at Oldtown, Me., as the winner of the free dinner awarded that member traveling the longest distance to the meeting.

The Secretary then noted the absence of Horace J. Cook, Auburn's Sup't, at home sick. This comment was especially noteworthy when it was known that Mr. Cook had never in the 18 years of the Association's existence missed a meeting before. This record is the more impressive when realizing that M.W.U.A. holds not fewer than 6 meetings each year. Members heartily approved a motion made to send "Wheel-horse" Cook a special message of well wishes for a speedy recovery, and appreciation of his splendid work over the years in the Association—most recently as Chairman of the highly active Defense Committee, which every year of the past several has been voted sizable sums to conduct its important work of inventory gathering, mutual aid, and redistribution of surplus materials.

Report of the Defense Committee

In the Chairman's absence the Defense Committee Report was presented by Leo. K. Saduns, of Augusta, secretary of the committee. The report stated in the beginning that Water Works Managers believed that salaries of water utility employees should be raised for the duration at least—or as long as living costs remained up. Attention was directed to the fact that it is not necessary for increased salary approvals to be gotten from the War Labor Board or Internal Revenue Commission in the case of publicly owned utilities so long as prevailing local rates for equivalent work are not exceeded. This ruling was made Dec. 26, 1942.

Post war considerations were stressed with an urge that managers not delay further planned betterments for labor relief when the shooting war is won.

The inventorying of plants continues and now inventory blanks have gone out to all Maine utilities with 300 or more services. A plea has made for their completion without further delay.

R. S. Weston Consulting Engr. Boston (Distinguished Guest)

A. F. McAlary Supt. Rockland, Me. (Association Vice-Pres.)

Concerning chlorine supply, the General Preference Order M-19 as amended Dec. 7, 1942 again calls for placing of all orders before the 10th of the month for chlorine subject to delivery during the month following. (Also it should be stressed that the prompt return of empty cylinders is again urgent, if a continuous flow of chlorine is to be maintained.—Ed.)

In reviewing the new Preference Order U-1 which replaces the old P-46 order, the report called attention to the higher priority ratings given for maintenance and repair needs. AA-2 for routine needs and AA-1 for emergency needs. However, it is required that when the AA-1 rating is applied on orders for equipment or materials that permission must be gotten from the W.P.B. district office or from the Power Division in Washington. On all orders for copper, brass or bronze the end use number DP-12-10 must still be placed on the order with the priority rating.

The report pointed out that it would appear that the pinch in C. I. pipe and fittings had passed, since one producer had offered 6 in. pipe to Auburn and Sanford for Naval Air Stations at a price below that at which water works managers would wish to sell their surplus, if any. And pipe delivery is assured in 7 days in these two cases.

Information from W.P.B.

To discuss recent developments pertaining to water utilities in the War Production Board and more specifically to answer questions, *W. B. Ranger,* Manager of the Portland District Office of W.P.B. (142 High St., Portland) appeared.

To Mr. Ranger had been directed four questions in writing, which he first answered.

(1) Is a water utility permitted to install a meter on an old service not heretofore metered?

The answer: Absolutely. The only limitation is the F-43 requirement that the total of new meters used in any quarter of the year be not in excess of 15% of meters junked in the same quarter of 1940.

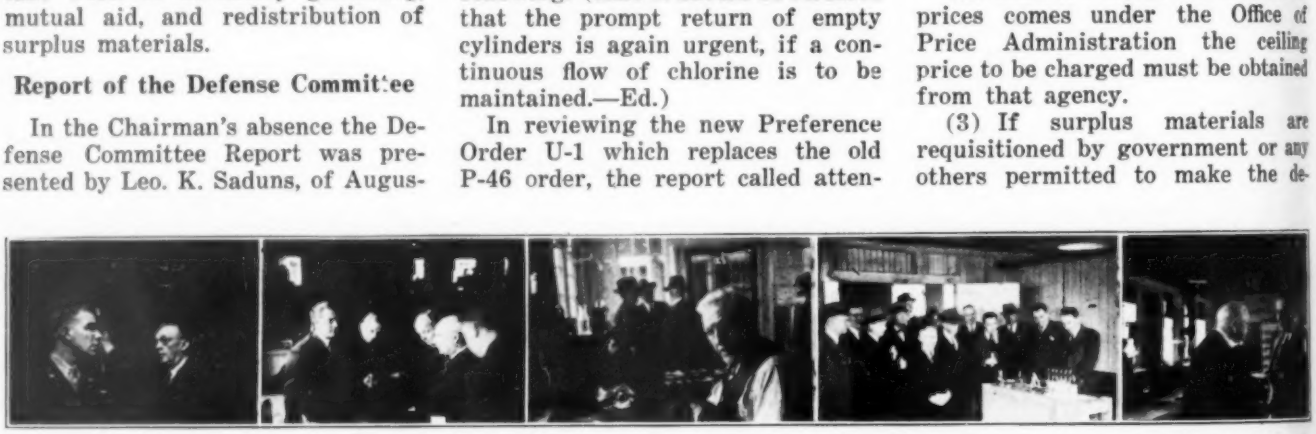
(2) When surplus inventoried materials are sold by the water utility what is the price limitation?

The answer: Since the matter of prices comes under the Office of Price Administration the ceiling price to be charged must be obtained from that agency.

(3) If surplus materials are requisitioned by government or any others permitted to make the demand what protection is afforded respecting payment for such?

The Answer: While it was true that some surplus or frozen copper stocks had been requisitioned by Federal authority at 55 per cent of the ceiling price, the "victim" has recourse to suit after the war.

The question of whether or not a utility in one state has the right to



Capt. Francis McAlary at the microphone; Chrm. Randlett looking on.

Fred Reny has an interested audience. From left: Hayes, Jacobs, Lufkin, Reny, Anthony.

Clifford Fogg, PWD's chief machinist and meter repair expert, looks up from a job just as the camera clicked.

J. W. Fuller, State Health Dept. chemist, demonstrating the Bovee (Los Angeles) poison gas detector.

"Al" Lash of Geo. A. Caldwell Co. (right) and Chas. E. Morrill of Bramas, Dow & Co., Boston.

demand that a utility in another must sell to it some of the other's surplus was wholly one of legality and not subject to answering at present.

(4) Can copper and/or brass pipe be used in hot water systems?

The Answer: Yes, copper and brass are still permitted to be used in hot water systems—if it can be gotten by the user.

Mr. Reny at this point commented that the Portland Water District had on hand 3,000 ft. of copper tubing which was being held on Washington orders for resale or seizure by the Federal agencies. If taken away at a monetary loss to the people of Portland it would be considered extremely unfair, although at actual cost it would be gladly released. More serious was the matter of large pipe fittings. If these be taken away replacement in emergency would be very difficult if not impossible in time—a likelihood of "too little and too late" again.

Replying to this matter, Mr. Ranger stated that the W.P.B. Materials Redistrbution Office in Boston seemed to be in splendid shape and it was his opinion that through the Portland office, information as to where a critical part or fitting was to be obtained most quickly could be secured by anyone in 3 hours' time.

Mr. McAlary of Rockland, asked if a utility and an authorized buyer of surplus materials could arrive at a satisfactory price between themselves. Mr. Ranger replied yes, if the agreement meets O.P.A.'s price requirements.

At this point L. H. Enslow, Editor of this magazine, read the following as one of a group of resolutions directed to W.P.B. by the A.W.W.A. Board of Directors in January:

Whereas, It is the opinion that regulation No. 204 of the O.P.A., establishing ceiling prices for surplus inventory items of utilities, is one deterrent to the prompt disposal of surplus inventoried materials; be it

Resolved, That W.P.B. be requested to have the O.P.A. revise this regulation so as to provide a simpler and more equitable method of compensation for water works surplus items. Cost, plus handling charges, is suggested as the simplest and fairest method.

At the same time A.W.W.A. members have been advised to consult with their legal counsel, looking toward taking steps to employ emergency procedures which will enable the manager of the publicly owned water utility to purchase or sell surplus materials when expedient or necessary to do so. The idea is that of removing what legal barriers may exist to make trouble for the well meaning water works management.

By unanimous vote the A.W.W.A. resolutions, as read, were endorsed by the Maine Association with a record of such to be mailed to the Secretary of A.W.W.A.

Two speakers represented the U. S. Engineer's Corp. on the afternoon program. The first was *Captain Francis McAlary,* Office of the Chief of Engineers, Washington, D. C., a fine looking young officer, introduced by Chairman Jo. Randlett of Richmond, Me. as one of Maine's boys no other than the son of Allan McAlary, Sup't. of the Rockland and Camden Water Co., Rockland, Me.

Captain McAlary gave an interesting review of the job and duties of the Post Engineer, his position in the Post organization chart, etc. Best overall description was that this man of many duties and responsibilities is a Military City Manager except for jurisdiction over police activities. His staff in fact is almost wholly civilian employees, whch operates without military obstacles or red tape. The Post Sanitary Engineer is the civilian staff member in full charge of water, sewage and wastes disposal. In the fire department the staffs of Post Engineers have about 80% come from Fire Underwriter's organizations. The best Post Engineers are those originally trained as City Managers. On the pay rolls of the Repairs and Maintenance Division there are approximately 450 for all camps and posts.

Major Guy E. Griffin, from 1st Corps Area Headquarters, Boston, could also claim Maine as his adopted state early in life. He, a Sanitary Engineer, was connected with the Metcalf & Eddy firm before becoming Sanitary Engineer of Greenwich, Conn., which position he left to enter the Engineer's Corps.

Major Griffin highlighted the *"Water Supply Problems in Army Camps."* Design and construction is handled in the Division Engineer's Office which usually retains consultants from the civilian field. The Sanitary Engineer Section of the Division Engineers Office handles maintenance and repair projects; contracts for services and supplies; makes water waste surveys; looks after meter reading; recommends corrections of sanitary and mechanical defects. In Washington Colonel Lewis is in charge of all Post Engineers. His office supervises purchasing and handling of equipment and supplies, including chlorine and hypochlorite, provides technical service in connection with operation and maintenance of water and sewage purchases; makes inspections and review of such facilities; acts in cooperation with local and state

Programmers

(1) (2) (3) (4) (5) (6)

(1) *Everett O. Boothby, Asst. Supt., Portland Water District Portland, Me.*

(2) *C. Raymond Moore, Asst. Engr. Portland Water District Portland, Me.*

(3) *Major Guy E. Griffin U. S. Engrs., 1st Corp Area Boston*

(4) *Leo K. Andrews, Auditor Augusta Water District Augusta, Me.*

(5) *Captain Francis J. McAlary Office of Chief Engrs., U.S.A. Washington*

(6) *Ralph A. Ranger, Distr. Mgr. War Production Board Portland, Me.*

Snapped During the Presentation of Papers and Demonstration

"Pat" Kelly, Leadite Co., Boston — *Maurice Libby, Supt., Bath, Me.* — *Arthur Burke, A. & F. King Co., Boston* — *Walter A. White, State Dept. Health, Portland* — *"Gerry" Manahan, A. P. Smith Co., East Orange, N. J.* — *"Dan" Atwell, Pbg.-Natl. Meters, Boston* — *Milton K. Thorne, Supt., Portl'd Water Dis.*

health authorities. The Post Sanitary Officer (Sanitary Corps) comes under the Post Surgeon. His duties are principally those of inspection, rather than operation.

Major Griffin then highlighted a few of the problems in water supply and sewerage dealt with in various un-named camps and posts. One was a salt water intake pipe clogged with shell-fish growing on the pipe interior wall. Heavy shots of chlorine was being used to suppress the growth of the spawn. Corrosion control continued a large and important problem. Lantern slides pictured the "spiffy" mobile trailer laboratories which the Coca-Cola Co. had just placed in service before turning them over to the U. S. Engineers. These units had performed a valuable service in travelling from post to post. The mobile chlorinating units (also pictured) had been of first rank value in numerous problems both in water and sewage. Nine such units were now in use in the 1st Corps Area, the newest being a Wilson three tank solution feed unit and 75 gpm. operating pump. Space does not permit further description of this unit involving the air displacement scheme in dosage control.

Water conservation had been one of the most waterworthy of the results showing functions of the Sanitary Section in connection with 7 posts in the 1st Corps Area. Water waste had been corrected to the extent of reducing the consumption of 120 gals. per day per soldier in 1941 to 50 gcd. in 1942—such being pictured in record graphs showing that total water use had been on the decline even in the face of rapid rises in camp populations. The correction had involved leak stoppage but principally waste due to types of toilet fixtures installed and high pressures carried on the system. Alteration of fixtures and pressure reducing valves had accomplished the major portion of the waste reduction—50 gcd. being a reasonable figure. Of course, this reduction extended savings in operating costs through to the sewage handling and treating facilities in addition to saved water costs and the at one time assumed need for amplifying the water supply facilities.

J. A. Jackson, Asst. Treas.

Harold Scales, Chemist

Portland Water District

President Moulton in Florida

From Dave Moulton, President of the Association spending the winter in Florida, came greetings and best wishes read by Jo. Randlett who was acting in the absence of President Moulton and Vice-President Monson of Calais.

The Cave That Jack Frost Built

(On the Cover)

Here is the full picture of "The Cave that Jack Frost Built"—a close up of the "cavern" entrance appearing on the front cover.

Up in New England where it really gets cold water works men have handy bleeders on lines likely to freeze up and they serve a useful purpose of keeping water moving through the line to prevent solid freezing. This winter with temperature dropping to 30 and 40 below these bleeders have been doing duty.

Here is a picture of what happened to the spray from a bleeder in Hingham, Mass. Much of the fine spray never reached ground and this interesting nature-built "igloo," enclosing a tree and bushes, resulted.

For these interesting snapshots we are indebted to Thomas F. Culliney of the Cohassett Water Co., Hingham, Mass.

A.W.W.A. Moves Into New Offices

Since March 6, A.W.W.A. headquarters have been located at 500 Fifth Ave., New York City.

Because of the expanded activities of the Association, more floor space for the headquarters office became a MUST. Being unable to obtain the needed additional floor space in the former location (Johns Manville Building at 22 East 40th St.), the move was a necessity rather than a desirability.

The centrally located 500 Fifth Ave. Building is at 42nd St. and Fifth Ave.—said to be "the world's busiest crossroads."

CHLORINATION—ROUTINE AND EMERGENCY*

By CHARLES R. MOORE
Assistant Engineer,
PORTLAND WATER DISTRICT
PORTLAND, MAINE

The Author

OUR officials of the Portland Water District have, to use a current phrase, "Gone all out for chlorination." This certainly seems a very wise stand, since it is not possible to state how soon an emergency may arise which would tax all of our facilities, and the knowledge of the District's trained personnel.

The Portland Water District, in anticipation of this possible emergency, now has a well trained Chlorinating Crew available at all times, ready to apply their knowledge and training to the actual performance of this important phase of water works operation.

In pre-war days when new distribution mains were installed it was the common practice to give these new installations a thorough flushing with clean water, after which they were put into service. Recently, however, we have systematically chlorinated all new work. In following this procedure, we have accomplished two distinct purposes. We have eliminated all chances of possible pollution in these new mains, in addition to giving our sterilizing crew a thorough training in the actual performance of this important work, since practically the same procedure would be necessary for emergency chlorination following any disaster which may require main replacements or major repairs.

During the past year (1942), there have been several new installations of distribution mains due to the extensive building program in the Portland defense area. A large portion of this work has been constructed by contractors who have given very little, if any, consideration to the sanitary condition of their work. Therefore the Portland Water District has been further justified in taking this added precaution, so that these new customers might have the same safe water to which all others in the District have been accustomed.

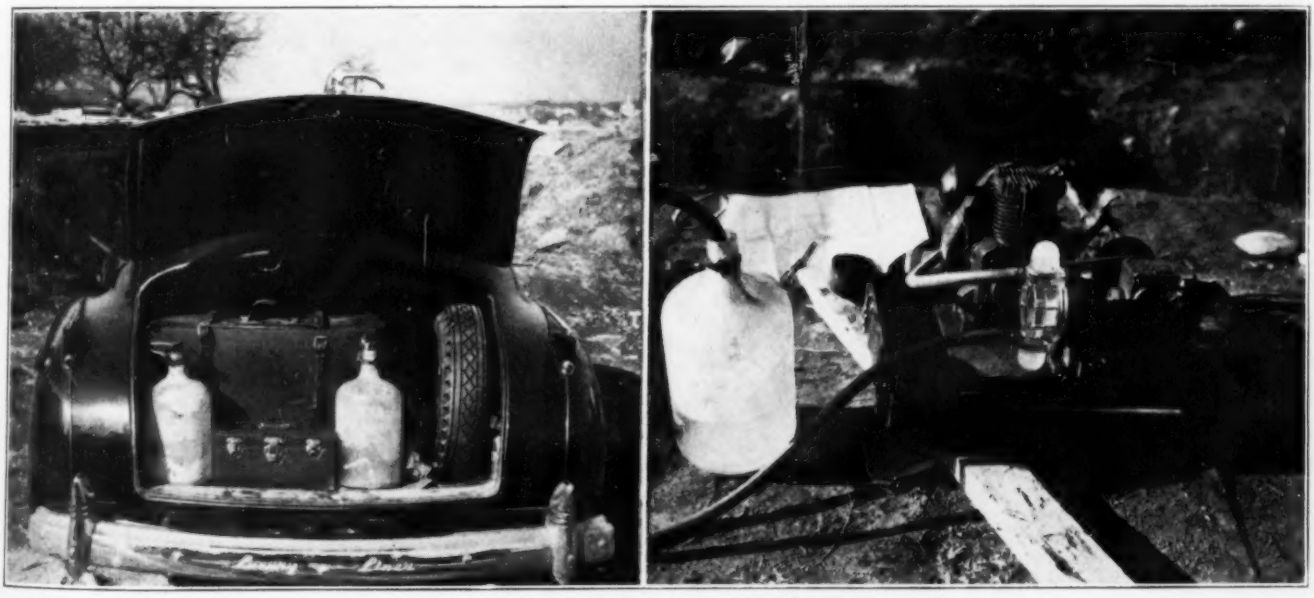
A Typical Case

A typical housing development in this area is the Stanwood Park Project, located on Highland Avenue and Evans Street in the city of South Portland. This particular project has 141 single family dwelling units.

In chlorinating this development with its distribution pipes ranging from 2 in. to 6 in. and laid in the various streets which an architect had designed in circles and curves (possibly with the thought of encouraging temperance), the first requisite was to determine which gates should be operated and in what sequence.

A detail plan of the development was provided which showed the location and sizes of the various mains, with gates indicated in their proper location. This same procedure should also apply to emergency chlorination, since a more intelligent and efficient job can be accomplished by having accurate plans for guidance in the procedure.

*A paper presented before the Maine Water Utilities Association, Portland, Me., Feb. 9, 1943.



P. W. D.'s EMERGENCY CHLORINATING UNIT

In the carrying case is the Midget Chlor-o-Feeder, with two carboys of bleach-water containing 2.6% available chlorine. The chlorinating unit (right) is set up on the job in a few minutes and ready to go.

The Equipment

The emergency chlorinating crew of the District uses a Proportioneer's gasoline engine driven portable midget chlorinating unit.

This equipment, enclosed in a convenient carrying case, is light in weight and very compact. It fits into the trunk compartment of a motor car, and can be handled with little difficulty (see cut).

Although the Portland Water District has other portable sterilizing equipment, which could also be used in the event of an extensive emergency, it has been found by experience that the midget portable chlorinating unit performs very satisfactorily under any conditions. Efficient cold weather performance was demonstrated this winter at the Redbank Project when the temperature was close to 0°. (The efficiency of the chlorinating crew, by the way, was not quite up to 100 per cent under these conditions.)

OUT ON A JOB

While the author is turning in the water, Harold Scales, Chemist, is starting the feeder engine.

The sterilizing agent used in these operations (commonly known as bleach water) is obtained from the S. D. Warren Co. in Cumberland Mills, which is about four miles from our shops. This bleach solution of sodium hypochlorite is available for our use at any time and in any quantity, which makes a very desirable arrangement. It contains 2.6 per cent available chlorine or 26 grams per liter, and when applied to the water wasting through a blow-off or hydrant, or other predetermined outlet, at the rate of approximately 100 gallons per minute, the desired dosage of 50 ppm. of chlorine is obtained. This rate applies when the gasoline engine is throttled to low speed and with the cam on the pump set at 10, representing the maximum stroke. It would be possible to increase this rate of flow by accelerating the speed of the engine.

The Procedure

The chlorinating unit is attached to a corporation or convenient fitting previously placed in the main by the service crew. This connection should be as near the start of the new work as possible. The little gasoline engine of the chlorinator is started and the water turned on.

Nothing remains, now, but to wait patiently the prescribed time for the highly chlorinated water to reach the point of discharge. This is determined by taking samples of the discharged water at intervals and applying the standard ortho-tolidine test for residual chlorine.

The discharge outlet is then closed and the pump shut off. This solution is allowed to remain in contact with the pipe for a period of at least three hours, or longer, depending on the cleanliness of the pipe, and the urgency for water service.

After the proper contact period, the chlorinated water is flushed from the mains and services. Samples of water are taken at intervals and tested to determine when this is accomplished. The new or repaired system is then ready to put into service.

Chlorinating Table

The accompanying convenient Chlorinating Procedure Table has proved a very helpful guide in applying the correct dosage of chlorine when filling the section of various sizes of mains at the 100 gpm. rate and using the bleach water containing 2.6 per cent available chlorine.

We have recently heard of an inexpensive orifice nozzle equipped with a monometer which can be attached to a hydrant outlet or main end which will allow a reasonably accurate setting of the desired rate of flow at the discharge end, after which the chlorinator may be started at the desired predetermined setting of stroke length for the correct dosage. It is our thought that some such simple means of rate setting and control will further simplify the chlorinating procedure, since it is not easy to set and control the rate accurately by manipulation of the larger main valves for the same purpose.

REFERENCE TABLE FOR EMERGENCY CHLORINATION

Size of Main	Number of gals. per 100 ft. of main	Length of time to chlorinate 100 ft. of main at 100 gals. per minute	Gallons of Bleach Water needed for 100 ft. of main
2″	16	1 min.	¼+
4″	64	1 min.	¼+
6″	150	1.5 min.	¼+
8″	256	2.5 min.	1+
10″	400	4.0 min.	1+
12″	600	6.0 min.	1+
16″	1000	10.0 min.	2+
20″	1600	16.0 min.	4+
24″	2400	24.0 min.	4+
30″	3600	36.0 min.	6+

McCallum Made Chief of O.C.D. Sanitary Engineers

Major Gordon E. McCallum (USPHS), former assistant to the Chief Sanitary Engineer in the Office of Civilian Defense, has recently been appointed Acting Chief Sanitary Engineer.

Ralph E. Tarbett, Captain (U.S.N. Grade) in the U. S. Public Health Service, has been serving as Chief Sanitary Engineer for the O.C.D. up to his recall to duty with the Public Health Service, and the appointment of Major McCallum.

WAR AND POST-WAR PROBLEMS TOPIC OF NEW YORK MEETINGS

Meeting of the New York State Sewage Works Association and Annual Joint Dinner With A.S.C.E.'s Sanitary Division

BY HARRY A. FABER*
Associate Editor

(Second Installment)

The first installment of Mr. Faber's worthy report covering the contiguously held meetings of the Sanitary Engineering Division of the American Society of Civil Engineers and the New York Sewage Works Association was devoted wholly to the Sanitary Engineering Division's meeting. It is to be found in our February issue.

This year, in particular, it was especially evident that planning the meeting of the New York State Sewage Works Association to follow the sessions of the Sanitary Engineering Division of the A.S.C.E. is a mutually advantageous arrangement. About 250 members and guests were registered at the Association meeting on January 22nd—a larger attendance than was anticipated, considering present conditions.

At a joint luncheon with the Sanitary Engineering Division, Linn H. Enslow was the leader of a forum on the subject "The Influence of War on Sanitary Engineering." The participants, all nationally recognized in the field of sanitation, included representatives of such special groups as State Sanitary Engineers, Educators, Designers and Operators. Mr. Enslow, as chairman of the Division, also presided at the annual joint dinner of the two groups held on the evening of the Sewage Works Association meeting. The speeches on this occasion included comments from the President-elect of the A.S.C.E., the Executive Secretary of the society, and an address by the President of the American Water Works Association. Wm. J. Orchard acted as master of ceremonies and led the entertainment following the joint dinner.

New Officers

The following officers were elected to serve during the coming year:

President

Edward J. Smith,
Superintendent of Sewage Treatment, Niagara Falls.

Vice-President

William H. Larkin,
District State Sanitary Engineer, New York City.

Secretary-Treasurer (Reappointed)

A. S. Bedell,
State Department of Health, Albany.

Reappointed Assistant Treasurer

*Research Chemist, The Chlorine Institute, Inc., New York, N. Y.

Annual Joint Dinner, A.S.C.E. Sanitary Engineering Div. and N.Y.S.S.W.A.

and Assistant Secretary, respectively, were: J. C. Brigham, State Department of Health, Albany, and A. W. Eustace, District State Sanitary Engineer, Geneva.

Elected to the Executive Committee for a period of three years were: George Symons, Chief Chemist of

Chas. R. Velzy
Greeley & Hansen
Norfolk, Va.
(Retiring Pres.)

Edw. J. Smith
Supt. Sewerage
Niagara Falls, N.Y.
(Incoming Pres.)

the Buffalo Sewage Treatment Plant, Buffalo (after April 1st, Associate Editor of WATER WORKS AND SEWERAGE); George W. Moore, District State Sanitary Engineer, Rochester; and Herbert O. Johnson, Supt. Belgrave Sewer District, Great Neck.

At the general business meeting, it was announced that the New York State Association now has a membership of 655 and that there are five active local sections.

Joint Presentation of Kenneth Allen Award

Speaking at the joint luncheon, George J. Schroepfer, Chief Engineer of the Minnesota-St. Paul Sanitary District and President of the Federation of Sewage Works Associations, gave a progress report on activities of the Federation. He described the formation of a Committee on Post-War Planning to serve a timely purpose under A. M. Rawn, Los Angeles, as Chairman. Mr. Schroepfer commented on the resolution drafted by the Executive Committee of the Sanitary Engineering Division of the A.S.C.E., which recommended that the War Production Board establish a Sewerage Section in its organization, such Section to be staffed with experienced men. This resolution was accepted and passed by the Board of Directors of the A.S.C.E. and by the Executive Committee of the Sewage Works Federation practically simultaneously—see first installment in February issue for resolution.

The Kenneth Allen Memorial Award, given each year for the most meritorious paper of an engineering and research nature, was presented by N. L. Nussbaumer, Chairman of the Award Committee. It was given jointly to Professor Earle B. Phelps, Columbia University, and to John Bevan, Chemist, Guggenheim Brothers, co-authors of the paper, "A Laboratory Study of the Guggenheim Bio-Chemical Process," published in Sewage Works Journal, January, 1942. The award was accepted by Mr. Bevan, in the absence of the senior author.

Forum—The War and Sanitary Engineering

(Linn H. Enslow, Leader)

Following the joint luncheon, representatives of four fields, in which sanitary engineers are performing work of vital importance to the war effort, participated in a forum discussion.

"The Influence of This War on Sanitary Engineering."

(1) *Observations of a State Sanitary Engineer, Charles A. Holmquist,* Director, Division of Sanitation, New York State Department of Health.

Mr. Holmquist disclosed that the Conference of State Sanitary Engineers has determined the proportion of engineering personnel lost by State Health Departments to average about 40 per cent. In some states as much as 90 per cent and in many 50 per cent staff reductions have occurred. New York state has lost a total of 24 from its original 49 and has been unable to fill vacancies.

Even under normal conditions, such depletion would be serious, but now it creates problems of major magnitude. Many new requirements for services arise constantly: The

Abel Wolman, Sc.D.
Johns Hopkins Uv.
Baltimore, Md.

sterilization of new water mains serving military establishments, aiding in sabotage prevention, sanitary facilities which must be provided for new population centers, and milk control precautions in defense areas. There is not only a shortage of trained engineers but the universities are not training sufficient men in this profession to fill normal needs.

(2) *Observations of an Educator. Charles Gilman Hyde,* Professor of Sanitary Engineering, University of California.

Professor Hyde emphasized the fact that too many sanitary engineers lack adequate chemical, biological, and bacteriological training; either these fundamental studies

Ezra Whitman
Consulting Engr.
Baltimore, Md.
(Pres., A.S.C.E.)

Geo. T. Seabury
A.S.C.E.
New York
(Exec. Secy.)

must be made more generally available or such degrees must be restricted to those schools offering adequate facilities. The acceptance as sanitary engineers of individuals not fully qualified or experienced constitutes the real danger to the profession.

Now, and in the future, the trained sanitary engineer can occupy an exceptionally favorable position. His services are more in demand and his importance is better recognized. It is likely that the need for sanitary engineers in foreign service will continue for some time after the war.

(3) *Observations of a Designer. William M. Piatt,* Consulting Engineer, Durham, N. C.

In earlier wars, diseases due to unsanitary conditions were responsible for more deaths than were caused by wounds. In the present war, safe water supplies, modern sewage treatment, mosquito control, immunization against field diseases, and new drugs have made deaths due to preventable diseases lower in the army than in civilian life. In this accomplishment, the sanitary engineer has played a very important part.

(4) *Observations of an Operator-Manager.*

George J. Schroepfer, Supt. Sewage Treatment, Minneapolis, Minnesota.

Mr. Schroepfer pointed out that plant operators have been required to meet and overcome almost insuperable problems: Loss of personnel, heavier plant loads, scarcity of critical materials, etc. In solving these problems, direct contributions in the nature of temporary and permanent benefits have been made. While much can be accomplished by

individual effort, it should be recognized that many of these problems can best be solved by group action and committees of the Sewage Works Federation are active in this direction.

A. M. Rawn, Gen. Mgr., Los Angeles County Sanitation Districts, by

H. O. Johnson
Supt.
Belgrave Dist.
Great Neck, L. I.

Geo. E. Symons
Chief Chemist
Sewer Authority
Buffalo, N. Y.

invitation, related the loss of all but 3 experienced operators in Los Angeles County. He had found the Federal Works Agency a fine friend in these times; also the Defense Industry Corpn.

Address by Wolman Highlight of Program.

At the annual joint dinner, Major Ezra B. Whitman, newly elected president of the A.S.C.E., gave an enlightening background of sanitary engineering at the turn of the century. Much progress has been made from the simple requirements of his early days, including the original plant of Baltimore in 1912, the present complexity of modern sewage treatment.

George T. Seabury, Executive Secretary of the society, reminisced most amusingly on his many "unfortunate" experiences with sewage as a young engineer and closed by reviewing the history and growth of the Sanitary Engineering Division in the Society.

The address by Abel Wolman, Sc.D., Professor of Sanitary Engineering, Johns Hopkins University, Baltimore, and President of the American Water Works Association, was titled:

"The Sanitary Engineer in a Post-War World."

"The Sanitary Engineer in a Post-War World."

Professor Wolman predicted an extensive and prosperous application of sanitary engineering contributions in the period immediately following this war. Careful post-war planning must be undertaken at the present time, both for its future benefits and for its present benefits to morale. Most of the allied countries are already engaged in planning such projects and some progress has been made in the United States. Adjustments of heroic proportions will be required in returning our industry and population from a war to a peace industry.

At the end of the war, we will have accumulated a vast number of engineering projects, creating immediate needs for re-employment. Based on past construction, it is estimated that the water and sewerage field alone will require the expenditure of three-quarters of a billion dollars. In a report soon to be available, it will be shown that the Ohio River drainage basin has need for projects of this nature totaling 200 million dollars.

The international problem will provide both an obligation and an opportunity. No other country matches ours in the degree of public health protection; the same standards and facilities must be passed on to others. Recognizing that the financial and administrative difficulties are numerous, Professor Wolman called upon sanitary engineers to choose leadership instead of cynicism. In learning how to enable everyone to live well and safely in the future, the engineer has the opportunity for a broad, bright, and courageous future of his own.

Technical Papers.

"A Sewerage Project Designed Without Critical Materials," by Paul E. Langdon, Consulting Engineer, Greely and Hansen, Chicago, Ill.

Paul Hansen, of the above firm, read the paper prepared by Mr. Langdon. It was brought out that, in many cases, the construction of a sewage plant without the use of

Paul Hansen
Consulting Engr.
Chicago

S. T. Barker
Commander
U. S. Navy

critical materials is possible but far from practical. Such plants were frequently constructed, before the present century, without what we now consider critical materials; the intermittent sand filtration plants, for example.

Economy of space led to the construction of highly complex mechanized plants which require more and more technical supervision. Today, the designer must limit use of needed material with reference to the urgency, permanency, cost, and treatment required for a particular project. It may be possible to design a plant so that equipment not now available can be installed at a later date.

Illustrating the problems with a specific example, the paper described many unusual selections for one plant providing treatment by sedimentation and chlorination, with sludge disposal by vacuum filtration when equipment becomes available. No substitute can be found for sewage pumps and motors, though used equipment may possibly be located. Open conduits will be employed, to eliminate pipes and valves. Proportional flow weirs and stop logs will be of wood. Sludge scrapers can also be of wood and a unit may be designed suitable for transfer from one tank to another.

Direct steam heating of sludge as it enters the digesters is contemplated, and old wooden barges will serve for disposal of sludge into the ocean. The outfall sewer, 1,700 feet in length, of 48 inch concrete pipe, will require less than 40 tons of steel and will provide adequate contact time for disinfection. If chlorinators cannot be obtained, hypochlorite solution will be fed through an orifice arrangement.

A. M. Rawn, Chief Engineer and General Manager, Los Angeles County, California, Sanitation Districts, in discussing this paper, pointed out that substitutes for critical materials is not economical. While it is something which seemingly must be done, much additional labor and material must be used. In the southwestern states, preheating of sludge with steam has been found to maintain constant temperature and to eliminate the necessity for digester treating pipes. Many years of observation have shown sludge drying time on undrained beds to be only two times that required on well drained beds. Three simple oxidation processes used in the southwest are: Dunbar beds, oxidation ponds, and percolation beds. While each gives a relatively high degree of treatment, none is economical.

Commander Stanley Barker, U. S. Navy, referred to a recent directive issued by the Navy. This indicates that, while it is intended to cooperate as fully as possible with local and state health authorities, the very minimum of treatment and only present needed capacities must be

constructed in order to conserve critical materials and equipment.

"Vacuum Flotatio of Sewage and Industrial Wastes," by Dr. A. J. Fisher, Development Department, The Dorr Company, Inc., New York.

Based on general experience with the limitations of usual skimming devices, even when aided by pre-aeration, Dr. Fischer said that a special step was indicated ahead of primary sedimentation. The vacuum flotation process, as developed, includes: (1) Pre-aeration in order to introduce the maximum concentration of fine bubbles, applying about 0.025 to 0.05 cu. ft. air per gallon and using an aeration period as low as 3 seconds; (2) Deaeration to remove large air bubbles which would induce undue disturbance; (3) Flotation in a special device termed the "Vaccuator."

In the Vacuuator, a vacuum of about 9 inches of mercury is maintained to float the small, finely diffused air bubbles with attached solid particles. The scum is removed continuously up a ramp to the circular trough. The sewage enters and leaves through sealed ports so that vacuum loss is prevented, and the designs include provision for automatic maintenance of a constant degree of vacuum. Designs suitable for variable and for constant sewage level are available to meet specific requirements.

There are at present 19 Vacuuator units installed in 13 different plants; two for treatment of cannery wastes, four for treatment of raw sewage, and thirteen for recovery of fines from synthetic rubber manufacture. Suspended solids removal is usually used as the measure of performance, and removals of about 80 per cent are obtained on cannery wastes.

Dr. Harry W. Gehm, Associate, Dept. of Water and Sewage Research, Agricultural Experiment Station, New Brunswick, N. J., discussed the paper by Dr. Fischer. He poined out that many investigators have felt the attempt to settle all solids in sewage is against natural laws. Previous use has been made of the vacuum process for separation of paper pulp. The wastes studied in Vacuuator installations have been high in suspended solids, and it would be of interest to determine the removals possible from weaker sewages. He noted that this method of treatment should be applicable in chemical treatment and in conjunction with chlorine for grease removal.

R. F. Coltart, Engineer, Link-Belt Company, Philadelphia, Pa., also discussed the paper, describing special scum flotation equipment (not utilizing vacuum) installed for grease recovery. He referred also to an earlier vacuum process, used in Germany, for scum removal. He questioned the advisability of removing some of the heavier suspended solids by flotation when they would be very readily removed by sedimentation.

The Panel

Chas. G. Hyde
Univ. Calif.
Berkeley

W. M. Piatt
Cons. Engr.
Durham, N. C.

Geo. J. Schroepfer
Chief Engr.
St. Paul, Minn.

A. M. Rawn
Genl. Mgr.
Los Angeles Co.

"Grease Removal by Flotation," by Rolf Eliassen, Captain, Corps of Engineers, North Atlantic Division, U. S. Army, and H. B. Schulhoff, Assistant Chemist, North Atlantic Division, U. S. Army.

Grease constitutes a special problem at Army sewage treatment plants, especially where secondary treatment is employed. In the trickling filter type of plant, grease accumulates in zoogleal jelly (10 to 20 per cent on a total solids basis) and in activated sludge plants it accumulates in return sludge (10 to 25 per cent of total solids). Its removal ahead of primary treatment is desirable in order to prevent a reduction of biological activity.

Comparative studies of pre-aeration and aero-chlorination with diffused air are possible at one Army plant and similar studies may be made at another plant provided with mechanical pre-eration units. The vacuum process has been studied in the laboratory, alone and in conjunction with added chemicals. Grease removal (petroleum ether soluble matter) determinations are necessary in order to obtain consistent results.

Some of the data obtained indicate removals by the vacuum and subsequent settling process to be about: 55 per cent with no chemicals, 35 per cent with 125 ppm. ferric sulfate, 40 per cent with 125 ppm. sulfuric acid, 75 per cent with 10 ppm. clorine, 75 per cent with 70 ppm. paper pulp, 75 per cent with 50 ppm. alum, and 83 per cent with 100 ppm. alum.

W. Donaldson, Director, Bureau of Sewage Disposal, Dept. of Public Works, New York City, in discussing the paper by Captain Eliassen, described grease removal practice in the New York City plants. The sewage averages from 50 to 70 ppm. grease and only a small proportion is recovered as scum from primary tanks. Mr. Donaldson questioned the advisability of removing more than is necessary, stating that grease has greater value for gas production in digesters than has an equal weight of solids.

The city of New York has studied sales possibilities for grease from skimmings, totaling about 50 tons a month, but the problem of disposal is complicated. The skimmings would require rendering, either by the city or by a private contractor, and the actual profit from such a side activity seems highly problematical.

"Overhauling a Methane Gas Holder," by C. George Andersen, Supt. Sewerage and Sewage Treatment, Rockville Centre, N. Y.

Mr. Andersen described with the aid of lantern slides the procedure followed in the inspection and repair of a 5,000 cubic foot gas holder. Extreme care was taken to insure that no explosive or poisonous gas hazard would be created. About three weeks' work by the sewage plant staff was required to prepare, clean, repair, and return the holder to service.

Detailed cost records show that this job was done at a cost of approximately 36 cents per square foot. Total cost was $1,025 as compared with estimates of outside firms which averaged about $1,800.

When Mr. Andersen's paper is published in full, those faced with similar jobs will find much helpful information applying to their own problem. The many precautionary measures taken will be especially valuable.

THE SANITARY ENGINEER IN THE POST-WAR WORLD

An Address Delivered at the Joint Annual Dinner of the Sanitary Engineering Div. of A.S.C.E. and the N. Y. State Sewage Works Association

By ABEL WOLMAN, D.Sc.
Professor of Sanitary Services
JOHNS-HOPKINS UNIVERSITY
BALTIMORE, MD.

The Author

In his introduction of the speaker of the evening Wm. J. Orchard, as Toastmaster, completed his remarks with the following cataloging of the responsible jobs of high office that are being so ably administered by the remarkable fellow Wolman, whose parents emigrated from what is now battle-torn Southern Russia to America but a short time before his birth.

"Here is the president of the American Water Works Association, the immediate Past President, and now Chairman of the Executive Committee of the American Public Health Association, the Professor of Sanitary Engineering in Johns Hopkins University, a Consultant to the War Production Board, the Chairman of the Sanitary Engineering Committee of the National Research Council, and a member of the active engineering consulting staff of the War Manpower Commission.

"These are but a few of the responsible jobs that this man holds, and to those of us who have known him most of his adult life and who have always thrilled with satisfaction as we have seen him progress and fill every job that he ever took with overwhelming success, his continued progress and his continued service to mankind is a great, *great* joy to every one of us."

And, too, it is considered a real privilege that the writer has had in having attended the University with, having entered the professional field with, and worked with Abel Wolman—all of the time hopeful of absorbing some of his radiating brilliance.—L. H. E.

CHAIRMAN ENSLOW, Ladies and Gentlemen, "Friends of Sewage," and I hope friends of your present speaker, in spite of the introduction by your Toastmaster, I start with a full realization that one of the advantages in talking about the future is that there is no limit to your imagination, and there of course can be no controversy about your prediction. Any one in the audience is at liberty to argue with the speaker about the future, but he cannot summon up any data which will controvert any of the prophecies which I may venture to make this evening. I am well aware of that strategic advantage, and I am taking advantage of it primarily to discuss with you, more or less in a conversational mood, what it is that I pretend to envision in the future.

I do it not only to amuse you—which is one of the primary functions of an after-dinner speaker—but really to explore with you, as serious-minded participants in sanitary engineering practice, what the future holds. We may all be wrong. We may all have guessed wrong; and certainly I hope that all of us will have an opportunity to test that out, if fate is kind to us, and if we survive until after the war, to be able to take stock once again at such a meeting as this, in order to determine how far from accuracy we were.

But certainly there is no harm in taking stock; there is no harm in allowing our imagination to roam over the scene, and to try to visualize if we can what it is that the future holds for us. That particular task has been assigned to me. One of the reasons for it, I assume, is that almost every one in this room, men and women, are engaged, and have been for the last eighteen months, in the strenuous and primary task of winning the war. As I look around I see no individual who is not actively engaged in a day-by-day assignment, all of which is directed towards the meeting of the contingency of war.

It perhaps is a relief that this assignment is directed towards, not the present, but the future. It is a relaxation, let's call it, in the direction of leaving the problems of the day, which are certainly acute enough to warrant devoting all of your time to the present. Perhaps at midnight, when you are exhausted from the present, you should be allowed an opportunity to envision the future.

And my function is primarily, according to your chairman, to try to lead you into that future in order to try to see where we may stand in 1944, or 1945 or 1946, when the war is over.

Now, why talk about what we have learned to speak of as "D" day—Demobolization Day? All of us are familiar with "M" day, the familiar Army term for mobilization of all of our resources for winning the war. We are now turning perhaps for the next twenty minutes or so, to "D" day, that day which will arrive. Very few of us have any doubt but that we shall win this war, and we shall reach the day of Demobilization.

And when that "D" day is reached. where will we stand? What shall our activities be? How will we be prepared for it? And what, if anything, can a group such as this do in preparation for it?

I have pointed out, within the last ten days, in a group similar to this, at which some of you, I recall, were present, that there is an official sanc-

tion for thinking about the future. Strangely enough, there are a lot of people who believe we should not think about the future, that the problems of today are acute enough to take all of our attention. There are some who believe that we should not be utopian, that we should not be too theoretical or academic, to think that there will be a future.

Officially, however, the Selective Service Act, which provides for mobilization of all of the personnel of the United States for total war, includes a directive for demobilization. I am not sure how many of you are aware of that fact, that there was wisdom in the drafting of the Selective Service Act which recalled that there will be an after-the-war period, and directed the Selective Service group, at the same time that it was busy with mobilization, to concern itself with the equally important and equally imminent job of demobilization, to take care of a post-war United States.

In the past, from the standpoint of sanitary engineers, we had a long record of accomplishment, all of us, of course, quite unsatisfied with the degree of that accomplishment. If we measure it, however, by the numbers of dollars spent in the installation of sewage treatment devices, in the development of water supply, in the construction of new housing, we have a measure of what that part was in the pre-war period. We can as statisticians indicate what its volume was. In that pre-war period we were accustomed to spend for sewage disposal alone anywhere from $50,000,000 to $150,000,000 a year, and in the water supply field a slightly higher amount.

That was the usual run-of-the-mine type of expenditure normally available to the sanitary field. There were other expenditures, of course, in our country which were related to the general sanitary field and to the control of environment.

Some Fundamental Adjustments to Make

Then we entered the present, a highly complicated present, a situation abnormal in the sense of adjustment of all of our perspective, abnormal in the diversion which occurred from our accustomed peace-time activities. When we pass out of the present we have four or five fundamental adjustments to make. I mention them without discussion, merely to bring to your minds the fact that we have to make them in a fashion which should be as logical and as intelligent as a group of engineers can possibly make them.

We will demand a shift in national income towards peacetime purposes of approximately one-half of our total annual expenditure, a prodigious sum, a sum which is now devoted exclusively to wartime expenditure. We will have to find a way to shift ten million people from military occupation to peacetime occupation; to shift twenty million additional people from wartime industry to peacetime industry. We will have to shift all of industry from the making of wartime to peacetime implements. We will have to re-orient the disturbed and upset communities with which we are familiar, the Hampton Roads areas, the Houston, Texas, the San Diego, California, the Baltimore, the Kankakee and Peoria, Illinois, areas, to a peacetime status, and adjustment of heroic proportions and one which most people decide to meet by pretending to forget it, but which I submit the engineering profession cannot meet in that fashion.

Those are the problems of the present. What may we expect as to the future, when we attempt to make that adjustment? That is the field in which the sanitary engineer, among others, as citizens of this country and as professional operatives, is naturally interested in. What will that prospect be?

The country divides itself, in its popular opinion, into two schools with respect to the post war period. One expects nothing but the dismal, a collapse of the United States if not of the world. The other expects a prosperous period of unprecedented character, a desire to fulfill a long deferred set of needs of the community. So far as I have been able to determine, there appears to be nothing in the present, in the past or in the future which is on the side of the dismal prospect. There is every reason to suppose that if we are intelligent, if we are courageous, the future need not be anything but helpful and hopeful. There is no reason to suppose that the world will collapse after the peace. It is contingent, most people believe, on how well we are in position to support that world within or outside our country.

I have presupposed for most of my remarks the more optimistic future. I can't talk, at any length, about the kind of a prospect in which the United States is ruined. I see no point in discussing a future in which our own country has collapsed. I choose—not only because I prefer to choose it, but because I prefer to believe that it is the prospect that is most likely to come—that the United States of North America will survive, and that when it survives it will have the courage and the means by which to go on at a high level of prosperity.

Deferred Engineering Demands Accumulating

One of my reasons for feeling that way, from an engineering standpoint, is that by that time, whether at the end of 1943 or at the end of 1944, or 1945, we will have accumulated a set of deferred engineering demands which will be of heroic proportions. Only a prodigious lack of forethought, a complete lack of intelligence, should result in that dammed-up supply of deferred demands not creating a prosperity period.

Within our own field, which is relatively restricted, I would estimate that we will have a deferred demand with respect to housing of 3.7 billions of dollars of construction by the middle of 1944. We should have a deferred demand in the general public works field of 1.8 billions of dollars of construction; in the water supply and sewerage field, of approximately 750 million dollars. These figures, incidentally, which I am suggesting to you are not pulled out of the air. They represent a careful canvass of what has not been done since 1940; of what we have been accustomed to do in normal intervals and what we have not been doing from 1940 to 1942, inclusive. If we add to that the deferred jobs which we probably will not do in 1943, we arrive at the figures which I have quoted to you. Those figures may seem, at first sight, as optimistic, or perhaps outlandish. They need not be.

The forthcoming report, for example, on the Ohio River pollution survey, which should be available within the next sixty to ninety days, will indicate that in that one drainage basin alone approximately $200,000,000 of sewage treatment, public and private, waits to be accomplished, in that one basin. It represents the requirements of approximately twenty million people. If you were to apply similar figures to the urban population of the United States, the program for private and public abatement of stream pollution approaches, for the United States, approximately one billion dollars.

Those represent, in a specific and a very narrow field of sanitation, one of the serious problems of the post-war period, since most of our operations will be deferred until that time.

I could go on to enumerate all of the possibilities of work in our own country. I think no fruitful purpose would be served if I list statistically

for you, with the limited amount of time available, how many millions, if not billions of dollars of work remain to be done in a country which is living and which, as I say, I have assumed will continue to live during the post-war period. I am sufficiently free, at the moment, of hardening of the arteries—although not very far away from it—to feel that the future has to be viewed with sufficient courage to believe that it will be alive, that it will offer challenges in the sanitary field, that there will not be a moribund population, that there will be an expansion, even though perhaps slow, of our country's opportunities and necessities.

The International Problem and Possibilities

I leave the domestic or national scene to refer, for a moment, to the international problem and possibilities. Obviously, anybody who talks about future prospects on a global basis can talk about it only on the assumption that if and when peace is declared this country again will be a participant in post war operation. Again I make that assumption because I can make no other assumption in the light of the experience of the past five years. No longer do I think it is possible for the United States to retire—anl I use the word "retire" advisedly—to insular and isolated assumption of its world power. I can't conceive that we can withdraw into an insulated, continental, national, North American activity. If that is the case, we then have, in addition to our national obligation, and, incidentally, opportunity, an obligation and opportunity in the world at large.

That does not mean, as some people feel, that we become the universal Santa Claus, financially, for the world. It does mean that perhaps for the first time since 1789 we recognize that we are part of the universe, that as citizens of this country we have an obligation to the rest of the world. That perhaps is a new obligation, but it is one which I for one feel that our country will have to assume.

When it is realized that in the course of the last five years the major capitals of the most important countries in the world are no longer more than two days distant from Washington, we can no longer assume that we are insulated and isolated.

The Sanitary Engineer in Global Reconstruction

Regardless of the technique—and I want to say a word about that later on—regardless of the technique, financial, legal or administrative, we will probably enter a world in which this country will be a participant, not necessarily a dominant factor, in global reconstruction, I can conceive of no global reconstruction in which the sanitary engineer will not be a part.

There is no country in the world which matches the United States in the physical facilities for the protection of life, for the preservation of safety, and for the maximum protection of public health. The standards which we have established must pass to other countries. The experience which we have acquired must be made useful to other people.

If that assumption is correct, I can visualize—and I do not believe I am being entirely utopian or academic—that our examples of operations in the form of cooperative engineering effort will pass to every country in the world, if for no other reason than that the experience which we may have latent and developed in this country must be made available to every other country.

I have no patience—I do not know whether you have—with those groups in this country who scoff at the possibility of enlarging the sanitary safety of every country in the world. It is an ideal which I, for one, feel is a desirable ideal. I can't share the view of the most recent President of the National Association of Manufacturers that that view is a kind of international joke. I can't share the view, for example, that a T.V.A. on the Danube is a kind of Joe Miller resurrected joke. If it means the resurrection of any country in the world, I am for it as an engineer and as a citizen of that world.

In every country in the world there are potentialities in the field of sanitary engineering which have not even approached the possibility of complete consummation. There are many countries in the world which align themselves in the list of trying to reach our standards. Some of those countries I think have surpassed our efforts in certain directions.

There is in this audience, for example, a gentleman from South America who, I think, has moved forward in the direction of providing sanitary facilities in scope, in perspective and in visualization of the necessities of the common people of his country that we in North America might well take pride in. I refer to Mr. Sanchez. In his office in Latin America, in Peru, I was tremendously impressed, not only by the scope of his vision but by the general direction in which his Government tends to move. It is a page which I think North American Sanitary Engineers might well read with care, and might well apply with care.

A Pattern from England—a Probable Indicator

In England, for example, within the past few weeks, a Parliamentary Commission has reported—mind you, in the midst of the most severe bombing and destruction that the world has even known, England finds the time to think about the future, one of the most amazing contributions, I think, to thinking about the future that we have on the problem, of all things as to how to extend public water supply to rural areas; how can we make available to the small, scattered roadside community of 500 people or less the benefits and the protection of public water supply? It calls attention to the fact that it is feasible, that it is practical, and that it should be done and that it should be done now, not after the war! It is one of the curiosities of sanitary engineering progress.

We have discussed in this country, for example, more or less academically, the problem of passing on to crossroads communities the advantages of central public water supply. In general, it has met with a kind of wonder at the academic, utopian point of view of the man who suggested it. In England it is accepted as a desirability, and they proceed to find out how and why it can be done.

The engineers in this country, at the moment are engaged in discussing the possibility of developing, of all things, and in all places the River Jordan, your Biblical river of ancestry, the seat of your origins, as an R.V.A., a transplanted Tennessee Valley Authority on the river Jordan! Why? Because such programs seem to have the potentialities of power, the potentialities of making a new life and a profitable life for Syria, for Trans-Jordania, for Palestine, and for Iran.

Within the past week, the report of the Parliamentary Commission in England, for example, has just appeared, on establishing a T.V.A. corporate authority in Scotland, to rehabilitate an area through the auspices of the same type of structure that they describe as successful in the Tennessee Valley. I say they "describe" with a kind of sinister sense of humor, because it is still talked of in our country as one of the curiosities of the New Deal. The

English accept it as an advance in public enterprise, as an advance of opportunity in the field of civil and sanitary engineering.

And China

At this very time, China, than which there is no more disconcerted, no more bombed out people in the world, finds it profitable and timely to discuss the reconstruction of China. Again, of all places in Chungking there has been operating for two years a post-war planning committee. How in the world anybody in Chungking has the time to sit down and think of what you would do with China after you win, is beyond me, but they have a public works post-war program. They have a program for maternity hospitals, for water supply, for sewage disposal, for the correctives which they have been long in arrears in instituting. They have that time, now, and they are putting it to profitable advantage.

I mention these examples only because they illustrate that, in many ways, many of these countries look to the United States for precept, for advice, for guidance, for courage, for enthusiasm. They seem to think that we are a new country, an enthusiastic country, that we have had an opportunity to develop ideas and ideals that may be useful to them.

I do not pretend to say to this hard-boiled group of engineers, who preserve, properly, a degree of cynicism about any academic suggestion, that there are not problems attached to such a post-war period within and outside our country. There are many of them. In our own country, there are legislative difficulties, financial ones, administrative ones. On the worldwide basis, they are multiplied a thousandfold. All I do say is that in spite of those obstacles, for which, incidentally, many are preparing in this country and on an international level, in spite of them there is a future for sanitary engineers, a broad, bright, exciting, courageous future.

In the making of that future—I quote from Mr. Prince, the hard-boiled Vice-President of the General Electric Company, who says that "the post-war period is full of opportunities never surpassed in the history of the our country." He says, "Those opportunities are worthless, however, unless we can identify them, assay them, and prepare for them." Remember those words, "The opportunities are unlimited, and surpass any of those which have preceded this war; they are useless, however, unless we can estimate what they are and provide for them."

I emphasize them because they require, particularly from engineers, a choice between two roads to travel. That is just as applicable to the sanitary engineer as to any other man, a choice of two roads, a choice of leadership versus cynicism, a choice of courage versus a fatalistic acceptance of the dismal.

I have never been able to understand why the engineer, equipped as he always has been to meet the difficult technologically, has always stood on the side while the legal or the political muddle the situation. The future, to my mind, holds a challenge of a peculiar type for the sanitary engineer. He has many of the technological answers. He has few of the political, legal, administrative or fiscal answers. I submit that the time has arrived for him to devote part of his energy, part of his thinking, to the solutions of that subtle group of hurdles which prevent us from making the most of the future. Why shouldn't he be on the side of developing those answers?

Sanitary progress in this country and the world will move forward when we have fiscal answers, administrative answers, and legislative answers. They are not insurmountable, but I leave with this group as one of the challenges for the future a diversion from the technological, and a hope that the sanitary engineer and his collateral group of engineers will devote their energies to trying to find out how to do a thing, rather than to sit by and merely describe the hopes and ideals of the masses of the people as one of those silly concepts with which he cannot sympathize.

It is not a silly concept. Every group of people in this country and in the world has a right to expect and hope for an advancement in that field of endeavor with which we have been connected over a great many years. We should try to find the device, the road, the technique, the fiscal policy, the legislative authority, which will permit the people of this and every other country in the world to live well, safely and securely in the future. Thank you. (Applause)

W.P.B. Offers Aid to Sewage Equipment Manufacturers

Governmental Division Expresses Desire to Help Manufacturers Secure Materials for Producing Essential Sewerage Equipment

It is a great privilege to be able to certify sewage works and sanitation managers and operators that the Governmental Division of the W.P.B. is taking the attitude that one of the most effective means of assisting such managers and operators in proper and essential maintenance operation of sewage disposal facilities is to give all possible aid to the manufacturers of essential sewerage equipment in their problem of securing sufficiently high priorities to procure critical materials for production and filling orders.

This development is amply covered in a letter to this writer which, by authorization, is being reproduced here.

This proposed assistance to manufactures having priorities problems in sewage and water disposal equipment production, coupled with the decision of Director Warnick to establish a special Sewerage and Sanitation Section, as reported elsewhere in this same issue, seems to constitute what is envisoned as a truly remarkable betterment in the handling of municipal sanitation matters by W.P.B. This light of a "new day" should make for greater peace of mind amongst sewage works operators, and also those who are looked to to supply their essential needs and present an ultimate financial and/or public health loss to the community.

WAR PRODUCTION BOARD
WASHINGTON, D. C.

March 9, 1943 IN REPLY REFER TO

Mr. Linn H. Enslow
155 East 44th Street
New York City, New York

Dear Mr. Enslow:

Confirming my conversation with you, I would like to make it known to industries manufacturing sewage equipment and maintenance items, that I have instructed my staff to extend to them every cooperation with relation to their material problems in their dealings with the War Production Board. Our responsibility, of course, is primarily confined to the problem of service in the field of sewage and sanitation for the governmental agencies throughout the country. But, in order to do this effectively it is necessary that we have a knowledge of and an interest in the problems of the industries that service these units of government. Therefore, it would be appreciated by me if you would make my position clear to these industries through your publication.

Again, I want to thank you for your splendid cooperation.

Sincerely yours,

Maury Maverick, Director
Governmental Division

AT N.E.W.W.A.'S FEBRUARY MEETING

Superintendents and Chemists Hear About Plastics for Water and Sewage Works Uses; Discuss Cold Weather Difficulties and Coagulation Problems

By HARRY A. FABER*
ASSOCIATE EDITOR

Horace L. Clark, Sup't. Sanford, Me. (Acting President)

Frank J. Gifford, Consultant, Dedham, Mass., (Secy. & Treas.)

TO those who are able to attend only a few of the monthly meetings of the New England Water Works Association, their practical value is especially apparent. Somehow these one-day gatherings are able to provide the educational and technical program, and the personal and social contacts, equivalent to those generally found only in a two-day meeting. The meeting in Boston on February 18th was thoroughly representative in this respect.

During the morning, early arrivals were offered a session of the "Water Works School," at which Prof. George E. Russell of the Massachusetts Institute of Technology gave another of his interesting series of lectures in which some fundamental principle of hydraulics is analyzed and their practical applications are discussed. Then from eleven o'clock until luncheon at one o'clock, groups of superintendents and chemists gathered separately for practical discussions of their particular problems.

Following the luncheon, Prof. A. G. Dietz, Dept. of Building Engineering and Construction, M.I.I., presented a comprehensive paper on the subject of "Plastics in Water Works." Mr. Harold W. Hackett, American Board of Foreign Missions, recently returned to this country after twenty years' residence in Japan, described experiences and conditions in that country prior to and following Pearl Harbor. The program concluded with the showing of a sound film in natural color, "Our Neighbors Down the Road." This film was loaned by The Coordinator of Inter-American Affairs and was of special significance due to the talk made in the January meeting by Prof. Gordon M. Fair, based on his recent observations in South America.

*Research Chemist, The Chlorine Institute, New York, N. Y.

Association to Reduce Number of Meetings

Horace L. Clark, Vice-President of the association, announced at a brief business session that the regular April meeting and the Annual June Outing are to be omitted this year. The May meeting of the association will be held in Boston instead of the usual procedure of going elsewhere for that particular meeting. Both of these changes are in line with recommended reductions in travel and in recognition of busier schedules which necessarily reduce attendance.

Secretary Frank J. Gifford called attention to certain bills of interest to water works men that are now before the State Legislature. Some provide desirable authority for various activities of the State Health Department and of communities during the present war emergency. Two additional bills, both applying specifically to the water system of metropolitan Boston, have not yet reached hearings in committee. One of these would permit bathing and the other hunting and fishing in certain reserve reservoirs of the water system. It was pointed out that passage of these two bills would affect not only the metropolitan supply but, potentially, constituted a threat to other watersheds in the state. Upon motion by E. Sherman Chase, it was voted that the association should go on record as opposing passage of these two bills and should so notify the proper authorities.

Superintendent's Round Table

(Chairman: Don Calderwood, Engr., Pennichuck Water Co., Nashua, N. H.)

"Work of the Facilities Security Branch of the U. S. Army" by Lt.-Col. Donald T. Carlisle, Regional Facilities Security Officer, U. S. Army.

Prof. Geo. E. Russell, M.I.T. Cambridge, Mass., (Lecturer)

Don C. Calderwood, Engineer, Nashua, N. H., (Supt's Chairman)

Colonel Carlisle outlined the relationship of the Facilities Security Branch of the Army to industry, in the job of seeing that sabotage or other interference did not disrupt or slow down plant production where Army contracts are being handled. One of the principal jobs of the Facilities Security Branch is that of making plant and area surveys from which recommendations are made for protection against plant or personnel failures which may stop or slow down output of materials and equipment being produced on Government contracts. "Standards of Protection," such as have been so effectively produced and followed in the petroleum industry and oil-well fields in cooperation with the industry, was cited as an example of what is accomplished. Such a development in water supply operation and protection was to be devised and something in this direction had already been started through the U. S. Public Health Service. (It developed later through comment by Major Howard Potter of the U. S. Public Health Service that surveys of what might be termed the most critical water plants in the country had been made by the several State Water Coordinators, and these surveys had been sent to Washington for processing. However, lack of funds for the job was delaying such processing or review work in Washington.)

Colonel Carlisle emphasized the fact that water supply was considered one of the most critical mate-

rials in modern war the cessation of water supply being possibly as crippling to production as a bombing operation. In the country at large 743 water plants had been listed as critical already, there being possibly

Roger Esty, Sup't., Danvers, Mass., (Inter - connection with neighbor saved the day for him.)

Arthur King, Sup't., Taunton, Mass., ("Elevated pipe-line" storage kept his phone from ringing.)

1,000 which should be so classified. There were four classifications. No. 1 water plants, were those that if the output of supply failed plants working on No. 1 priority contracts would be shut down. No. 2 plants were those in which breakdown would interfere with but not completely stop production. The No. 3 group would stop production in plants operating on No. 2 priorities contracts. No. 4 were all other plants supplying critical areas—domestic or industrial uses.

From surveys already made it had become apparent that many water plants need attention from the standpoint of "Standards of Protection" and freedom from chances of failure, and vulnerability to saboteur operations. In listing the first four factors of importance Col. Carlisle put history and dependability of personnel as No. 1 on the list. No. 2 was facilities and equipment for plant protection. This included guarding, fencing, lighting, alarm systems, etc. No. 3 was adequacy of equipment for proper treatment, pumping and transmission. No. 4 was adequacy of fire protection, condition of mains, adequacy of distribution storage, etc.

It was pointed out to Col. Carlisle by Mr. Quirk of Peabody, Mass., that water supply has apparently been slow to receive the recognition by the O.C.D. which the Facilities Branch seems to think its importance deserves. Mr. Chase of Boston wanted to know: Could the Branch aid in securing betterments that the W.P.B. had not given the necessary priority to secure. The answer to the priorities question was "No."

Wm. B. Duffy, Sup't. Public Works, North Andover, Mass., wished clarification on the question—"Will the Army or the Facilities Branch merely recommend guarding where thought advisable, or order such?" The answer was that Army could not order anybody to do anything and therefore could only recommend.

Fred J. Ring, Gen'l. Mgr. Portland, (Me.), Water District, stated that his instructions to provide guards at all vulnerable points on the Portland system came from the O.C.D. Later the Army made an inspection of the protective measures and guard arrangements which had cost the District $30,000 per year to maintain. He didn't believe the cost could be justified, because the scheme was not wholly adequate or a protective measure. Further, the question of manpower was becoming a problem. Perhaps husky women might do as well as men. Col. Carlisle replied that women were being used and that dogs, properly trained, made excellent guards.

Round Table Topics

The Chairman referred to Selective Service Bulletin No. 9, issued Feb. 2nd which contained a listing of key operating men in water plants who would be deferred by local draft boards if the employer (or employee) filed the request on form 42-A provided for such. Asking the question—"How many men present had gotten employees deferred?"—apparently almost no deferments had been requested by water works managers in attendance.

Cold Weather Problems

Chairman Calderwood commented on the great number of pipe and main freeze-ups this winter as compared to recent winters. The explanation seemed to be in the fact that the fuel shortage was responsible. Less heat in homes meant more frozen pipes, and more frozen pipes meant less flow in mains; and, in consequence, more frozen mains in outlying sections. In Nashua there had been more meters to freeze in cellars than in the past 16 years. It was observed that many members were not present at the meeting because of the cold weather.

Roger Esty, Sup't. at Danvers, Mass. cited the large number of pipes freezing this winter in the walls of Danvers' homes—also the problem of water tanks freezing and bursting. He told of a boxed in exposed main freezing that never froze before. Fortunately an interconnection installed earlier with the Salem, Mass. system saved the day while the main was being repaired.

Arthur C. King, Sup't. at Taunton, Mass. cited the case of an 8 in. main freezing where it crossed over a bridge. Most interesting was the fact that with this main freezing for 3 days ten consumers across the creek had been obtaining water all the time. The mystery "reservoir" proved to be the long run of the 8 in. main up a hill, and consumers in the area lower down were drawing from Taunton's "elevated pipe line" all the water required for the 10 homes during the frigid 3 day period.

Harry U. Fuller, Chief Engr. Portland, (Me.), Water District is something of an authority on "temperature deficiencies," and a student of frost penetration predictable for records of "temperature deficiencies." In reply to the Chairman's questions, he said that the extreme low temperatures (40 and 50 below) this winter had resulted in an 800 degree deficiency in temperature, with the frost now down 45 inches. This was almost as bad as the tough winter of 1935. However, 1917 and 1918 were the prize bad years of the past quarter century.

Chairman Calderwood complained of an auxiliary firemen nuisance. Finding of hydrants frozen solid could be traced to the activities of these auxiliaries.

Wm. "Scotty" Marshall, Sup't. at Georgetown, Mass. brought the session to a close in laughter. His was a darned amusing story of a Georgetown woman suffering from

Harry Fuller, Chief Engr., Portland, Me., (Temperature deficiency expert.)

Sherman Chase, Const. Engr., Boston, (No. 1 Resolutor.)

"troubles with her dead-end." But, "Scotty's" story wouldn't get by the censor, so you'll have to ask "Scotty" to tell it to you sometime.

Chemist's Round Table

(Chairman: Kenneth F. Knowlton, Supt. and Chemist, Salem-Beverly Water Supply Board.)

"Coagulants and Treatment Plant Problems" was the general title listed for discussion by this group. Under the guidance of the chairman, many experiences with coagulants were described and much practical comment was forthcoming.

The problem of chemical feeding provided a logical starting point, and it was pointed out that excessive humidity in the chemical storage room sometimes caused difficulty at the very beginning. Other conditions applying to either alum or iron salts were that thorough solution of the coagulant should be accomplished before it reaches the raw water. In some instances, especially when water is very cold, the provision of longer dissolving time is recommended to prevent undissolved coagulant being carried through to the mixing chamber. Irrespective of the coagulant employed, the plant design should include adequate mixing, flocculation, and sedimentation facilities.

Recent experiences at plants employing prechlorination or breakpoint chlorination ahead of coagulation have shown this treatment to be generally advantageous and economical. With the new "war alum" and with iron coagulants containing certain amounts of ferrous iron, the addition of chlorine sufficient to oxidize iron definitely improves floc formation and color removal.

Sufficient sedimentation time is required if water with low turbidity is to be applied to filters and if long filter runs are to be obtained. Proper filter washing methods and the use of caustic soda for cleaning filter sand received considerable discussion. Members appeared unanimous in recognizing that the present art and science of coagulation was far from perfect at most water filtration plants. This round table, however, definitely provided means for progress in the right direction.

"Plastics in Water Works," by Prof. A. G. Dietz, Dept. of Building Engineering and Construction, Massachusetts Institute of Technology, Cambridge, Mass.

Professor Dietz explained that the term plastics is perhaps a poor name for this large group of materials which are quite hard and cannot be softened. The name is justified since any material so classified must have originally been capable of being moulded, have no counterpart in nature, be organic in composition, and must be the product of polymerization and condensation. The earlier types of plastics (celluloid, bakelite, cellulose acetate) and the large number of modern thermo-setting and thermo-plastic types, were described in some detail. The cost of all plastics is very high on a tonnage basis but, it was mentioned, the lignins hold promise of eventually provding a cheap plastic.

At present the principal uses of plastics are three: As powder, formed by heat and pressure into

Wm. B. Duffy, Supt., Public Works, North Andover, Mass.

Michael E. Quirk, Distribution Supt., Peabody, Mass.

Wm. J. ("Scotty") Marshall, Supt. of Water, Georgetown, Mass.

various shapes; as fillers to laminate with paper, wood, and glass fiber into sheets; and as an adhesive. The latter form probably constitutes the greatest tonnage use today, since plastic adhesives have been found to increase the usefulness of wood and add strength. Our greatest knowledge of applications in the field of special coatings for resistance to corrosion and abrasion.

In the sanitary field, plumbing fixtures, tubing, valves, etc., have been produced from plastics and should be thoroughly practical. Their adoption will be definitely determined by relative cost. Today their cost is too great, but expansion of plastic production under the stimulation of war requirements may reduce their cost to an economical figure. When plastics provide some superior property, they cannot be compared on a cost basis. The recent utilization of synthetic resins for water treatment (as anion and cation exchangers) appear to have wide economic possibilities.

In reply to questions, Prof. Dietz explained that the plastic tubing offered for water piping is suitable for water temperatures up to about 200° F. For interior pipe coatings plastics are available, suitable for application by brushing or spraying, which are highly recommended for special purposes. Synthetic resins are not suitable for removing salt from sea water because of the very high concentration of ions in that liquid.

W. & S. Manufacturers Association Moves

Offices of The Water and Sewage Works Mfgrs. Ass'n, Inc., are now located at No. 12 East St., N. Y. City.

Prior to March 1, the address of the Association's headquarters was No. 22 East 40th St.

Another Reminder on Chlorine Cylinders

Situation Again Draws WPB and OWI Comment

In a recent letter to manufacturers and distributors of compressed gases, Donald M. Nelson, Chairman of the War Production Board, warned that the shortage of compressed gas cylinders would "become more acute as the war increases."

A statement by the Office of War Information, issued since Mr. Nelson's letter, pointed out the concern producing shortage and said there probably will be no additional steel cylinders made available to the industry.

Mr. Nelson commended manufacturers for their efforts to obtain more rapid cylinder turnover, but at the same time stated that, if the results were inadequate, the WPB is prepared "to implement conservation measures by a suitable order."

The cylinder situation which has again grown critical is thus emphasized. And, every user of chlorine, ammonia, oxygen and acetylene can make a worthwhile contribution to the general war effort by seeing that every cylinder is returned as soon as empty, or essentially so even though it be one at a time, thus incurring an added effort in so doing.

A suggested sign to put up in a plant using cylinders:

Remember!
THE BOTTLE NECK
Is *STEEL*
CYLINDERS.

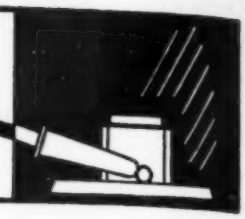
Army Shipping Water to Troops Abroad?

Although this statement cannot be confirmed at the instant, it has been reported that the U. S. Army is shipping sizeable quantities of water across seas to our fighting men on the fronts.

The reason for so doing is that waters available on the fronts has proved in many instances unsuitable for preparing dehydrated foods and cooking generally. The difficulty is that these waters impart objectionable tastes to the foods and beverages. In other words, tastes and odor is the problem rather than safety of supply.

If any reader has something to state in confirming or refuting this report, which has been going the rounds recently, we should like to have opportunity to make any necessary restatement.

The Editor's Comments



"On to Victory!!"

YES—*"On to Victoree!!"* That's the way radio's Gracie Fields sings it out to millions nightly for Pall Mall in her inspiring show over the air. This maxim and the inflection that Gracie gives to "Victor-*ee*" makes of it a dictum, to our thinking.

The assumption is that every reader of this page is doing something in his own way to speed the march to *"Victoree."* The water works operator is watching the weak spots and the vulnerable points in his system as never before. He is practicing the "Save, Share and Stretch" policy to the extent that never before has he been doing so much with so little, while observing his inventory of maintenance and replacement materials gradually diminish until most if not all of the so-called "fat" has gone and he now wonders how thin he should be, content to let the minimum working inventory "ice" get under his feet. In this matter the new W.P.B. Utilities Order U-1 is causing a number of water works managers real concern. So much so that the Maine Water Utilities Association and the New England Water Works Association have officially addressed pleas to the Director of War Utilities to amend the new order. The U-1 Order requirement considered too restrictive for safety is that set forth in section (f-2-i) of the order in which the limit of use of materials for the year 1943 is based on the use and purchases of such materials during the last nine months of 1942. In the language of the order the limit is fixed for 1943 as "four thirds of the aggregate dollar value of items of the same class used in maintenance, repair and as operating supplies during the last nine months of 1942."

The use of the "four thirds" value as the yardstick is baffling, unless such specification is more legal in the eyes of the attorney-composers than saying one and one-third of the dollar value of materials used in the last nine months of 1942, which it actually is. We understand that this limit was chosen as the result of reports and the use and inventory records filed with the Power Branch of W.P.B. (now the Office of War Utilities) by most if not all of the 200 largest water utilities in the country. The natural question is why are only the last nine months of 1942 used in setting the limits. The next question is, can the new limitation be safely stood by the smaller utilities, even though it must be a reasonable working limit for the larger utilities involved in supplying those figures used as the basis in setting the new limits.

It is to be recalled that it was not until after the first quarter of 1943 that the then Chief of the Power Branch of W.P.B., J. A. Krug, appeared before the Wartime Conference of the A.W.W.A. to make his telling appeal to water works authorities to trim the cloth finer in respect to purchases and inventories carried, and to adopt the "Patch and Pray" policy, and live on the "fat" accumulated in the water works store rooms and yards of the country. The plea was emphasized through articles and interpretive documents from A.W.W.A. headquarters, and by the several technical publications covering the water and sewage fields—also, later by the new Chief of the Power Branch's Water Production Section, and his co-workers, appearing in person before various sectional meetings of water works men. The net result has been that during the latter half of 1942 thousands of conscientious water works managers have in a most serious effort followed the "Patch and Pray" policy suggested. In consequence their purchase and use of materials, not considered essential for immediate work, practically reached the zero point during the last half of 1942. This seems particularly to have been the picture in New England where so many small and medium sized systems exist. It probably is the picture for other sections of the country also—and it seems almost axiomatic that as a general rule the smaller system managers have been the most conscientious operators in the present emergency.

In the Maine and the New England associations the small operator group has raised its voice (we feel certain justifiably) in protesting the hazard of the new limitation requirements (f-2-i) pertaining to maintenance, replacement, operating and repair materials and supplies. It seems to us that such an honest voice should not fall on deaf ears down in Washington.

Sludge for Victory Gardens

Readers who have charge of sewage treatment plants may recall that during 1942 (and earlier) WATER WORKS AND SEWERAGE contained several articles dealing with sewage sludge as a soil improver, and a highly useful source of nitrogen in these days of nitrogen scarcity for fertilizers. These articles emphasized the *"fertility* values" of digested sludge in contrast with fertilizer values, and in particular their value for local and nearby use. Some of the articles brought out the public relations side of sludge sales and also the neat financial return possibilities in the by-product end of sewage disposal, to bolster up the budget without pleading before the powers that be.

If there ever was a time when sewage works managers should become interested in having sewage sludge put to use as a soil improver this is the year. Victory Gardens in 1943 are to be the order of the day and probably many of these will actually be on city-owned lands—possibly on the very property of many sewage treatment plants. In any event, a golden opportunity is at hand to do a very splendid job in public relations by offering sludge to Victory Gardeners through the local press. Interest your local editors in what you have to offer. Secure some pictures of vegetables raised "with and without," such as have been appearing in *Sewage Works Journal*, WATER WORKS AND SEWERAGE and other magazines. These the editor will want for illustrating "The Story of Sludge Fertilizer for Victory Gardens."

To possibly assist the reader we refer to sludge use articles in our 1942 issues—Rudolph, p. 254, Reference and Data Section, June, 1942; Frazier, p. 118, March, 1942. In 1941 the following—Rawn, p. 186, Apr., 1941.

After receiving these articles we believe that every sewage plant manager will be convinced that one of his contributions in the *"On to Victoree!!"* program should be that of sludge for Victory Gardens.

MEETINGS SCHEDULED:

Mar. 25-26—TRENTON, N. J. (Stacy-Trent Hotel).
New Jersey Sewage Works Association. Secretary, John R. Downes, Plainfield, N. J.

Mar. 25-26—SYRACUSE, N. Y. (Hotel Syracuse).
New York Section, A.W.W.A. (Spring War Conference.) Sec'y-Treas., Rollo K. Blanchard, 50 West 50th St., New York, N. Y.

Apr. 7-9—HAMILTON, ONTARIO (Royal Connaught Hotel).
Canadian Section, A.W.W.A. Sec'y A. E. Berry, Ontario Department of Health, Parliament Bldgs., Toronto, Ont.

Apr. 8-9—SPRINGFIELD, ILL. (Hotel Abraham Lincoln).
Illinois Section, A.W.W.A. Secretary, H. E. Hudson, 912 W. Charles St., Champaign, Ill.

Apr. 12—MANSFIELD, OHIO (Mansfield-Leland Hotel).
Ohio Section, A.W.W.A. Secretary, L. J. Hoffman, 101 Municipal Bldg., Akron, Ohio.

Apr. 14—AUGUSTA, ME.
Maine Water Utilities Association. Secretary, Earle A. Tarr, Winthrop, Me.

Apr. 19-20—LITTLE ROCK, ARK. (Marion Hotel).
Arkansas Water and Sewage Conference (Annual Conference). Secretary, Harrison Hale, 114 Chemistry Bldg., Fayetteville, Ark.

Apr. 29-30—INDIANAPOLIS, IND. (Hotel Antlers Hotel).
Indiana Section, A.W.W.A. Secretary, Herman Horstman, 405 Traction Terminal, Indianapolis, Ind.

May 7-8—BELLINGHAM, WASH. (Hotel to be selected).
Pacific Northwest Section, A.W.W.A. Secretary, Fred Merryfield, Engineering Laboratories, Oregon State College, Corvallis, Ore.

May 14-15—BILLINGS, MONT.
Montana Section, A.W.W.A. Secretary, H. B. Foote, Director, Div. of Water & Sewage, State Board of Health, Helena, Mont.

June 4-5—ROCHESTER, N. Y. (Seneca Hotel).
New York State Sewage Works Association. Secretary, A. S. Bedell, State Dep't of Health, Albany, N. Y.

June 8—HARRISBURG, PA. (Hotel Penn-Harris).
Pennsylvania Water Works Operators' Association (Annual Meeting). Sec'y-Treas., I. M. Glace, 22 S. 22nd St., Harrisburg, Pa.

June 9—HARRISBURG, PA. (Hotel Penn-Harris).
Pennsylvania Sewage Works Association (Annual Meeting). Sec'y, Bernard S. Bush, State Dept. Health, Harrisburg, Pa.

June 16-18—CLEVELAND, O. (Statler & Carter Hotels). 1943 A.W.W.A. (Wartime Water Works Conference). Executive Secretary, Harry E. Jordan, 500 Fifth Ave., New York, N. Y.

June 23—MANSFIELD, OHIO (Mansfield-Leland Hotel).
Ohio Conference on Sewage Treatment. Secretary, J. R. Turner, % Sewage Treatment Plant, Mansfield, O.

(Continued next page)

STEAM* FLOW RATE IS *easy to record* WITH SIMPLEX TYPE MS METERS

THE FLOAT MAKES THE DIFFERENCE!

The famous Ledoux bell-shaped float used in Simplex MS meters, automatically extracts the square root of the law of flow. As a result the float moves in direct proportion to the rate of flow.

WHAT DOES THIS MEAN TO YOU?

1—Evenly spaced charts—this means easy reading at both low and high rates.

2—A continuous type integrator is used—eliminating intermittent integrator movement.

3—Accuracy—the float directly connects to the pen arm which assures consistently high accuracy at low, intermediate, and high rates of flow.

4—Elimination of friction producing cams and levers (it floats in water on mercury).

5—The precision machined hard rubber float is not affected by changes in temperature, nor by the type of liquid.

Movement of this specially designed float is caused by differential pressure from high and low pressure taps at Orifice plate, flow nozzle or Venturi tube. There are many varieties of Simplex type MS meters. Write today for your copy of Bulletin 52 describing in detail Simplex type MS meters.

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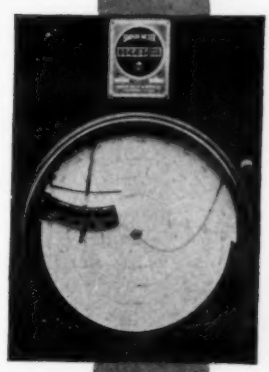
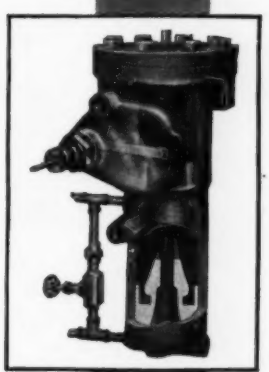


Type MS Meters for service as a flow indicator, recorder, indicator and recorder, indicator and totalizor, recorder and totalizor, or indicator, recorder and totalizor.



Bell-shaped float is sensitive to smallest change in diff. pressure and directly transfers it to pen, pointer, and totalizer.

SIMPLEX POWER & PROCESS METERS
THE METER WITH THE BELL SHAPED FLOAT

*Boiler feed, condensate, gas, air, water, etc.

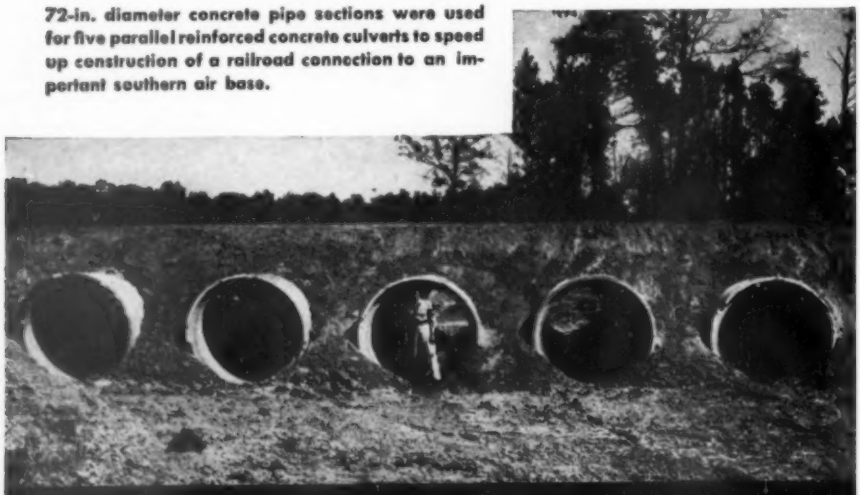
Sept. 16-17—DENVER, COLO. (Hotel to be selected).
Rocky Mountain Section, A.W.W.A. Secretary, O. J. Ripple, Supt. Filtration, Littleton, Colo.

Oct. 11-13—(Place not selected.)
Southwest Section, A.W.W.A. Secretary, Geo. J. Rohan, Supt., Water Works Municipal Bldg., Waco, Texas.

Oct. 21-23—CHICAGO, ILL., (Hotel to be selected).
Federation of Sewage Works Associations. Annual Meeting, "War Time Conference." Secretary, H. W. Wisely, Urbana-Champaign Sanitary District, Urbana, Ill.

Oct. 27-29—LOS ANGELES, CALIF. (Biltmore Hotel).
California Section, A.W.W.A. Secretary, H. Arthur Price, Box 3669, Terminal Annex, Los Angeles, Calif.

72-in. diameter concrete pipe sections were used for five parallel reinforced concrete culverts to speed up construction of a railroad connection to an important southern air base.



CONCRETE PIPE
widely available for vital war projects

Concrete pipe in many instances has helped speed up water, sewerage or drainage projects urgently required in important defense areas.

Concrete pipe combines the qualities of long life, maximum hydraulic capacity, great strength and low annual cost. Evidence of these qualities is found in thousands of concrete pipe installations under highways, railways and major airports as well as in municipal service.

And concrete pipe conserves critical materials. Established concrete pipe manufacturers are ready to serve you in nearly every community.

Technical assistance is available to engineers and builders engaged in important wartime projects involving concrete pipe or any concrete construction.

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Dept. A3-29, 33 W. Grand Ave., Chicago, Ill.

A national organization to improve and extend the uses of concrete . . . through scientific research and engineering field work

BUY MORE WAR SAVINGS BONDS

LITERATURE AND CATALOGS

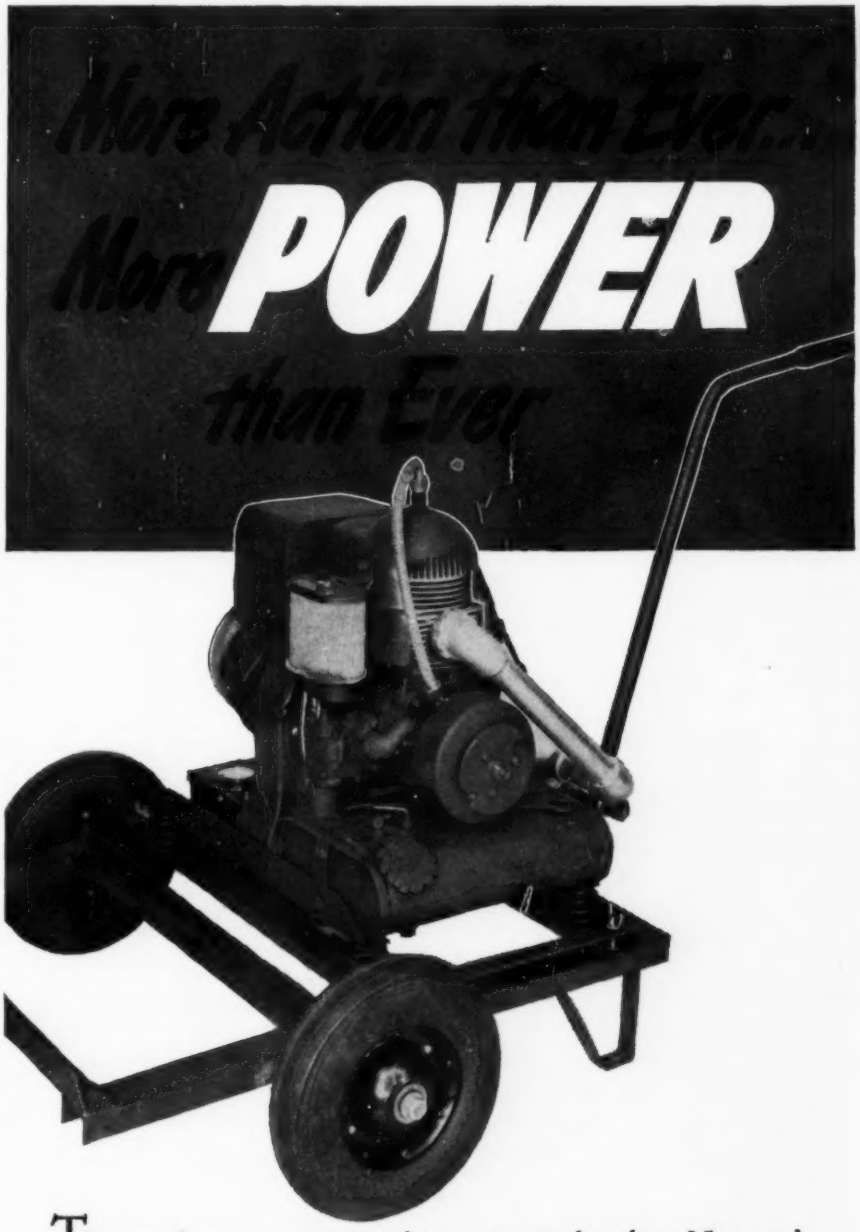
Eimco Continuous Vacuum Filters is the title of Bulletin No. 404 of the Eimco Corporation. Forty-eight pages of amply illustrated information on the subject of the use of these filters for metallurgical, chemical processing, food product, paper pulp, sewage disposal and many other modern industrial requirements, are contained in the Bulletin. General principles of continuous vacuum filtration, disc filters, automatic valves, accessory equipment such as repulpers, cake conveyors, agitators, thickeners, and so forth, are discussed. One section of the Bulletin concerns industrial applications, such as the metallurgical industry, the beet-sugar industry, the paper industry, sewage disposal and the dewatering of coal sludge. Top-feed filters, tank-type salt filters, acid-resisting filters, and filters for potassium chloride or other special applications are described and discussed. These filters are custom built to meet individual needs and engineering and laboratory service is available with no charge for laboratory tests, recommendations, estimates, proposals or preliminary design. Another section of the Bulletin contains a short description of other Eimco products for the mining, metallurgical and chemical-process industries. This informative Bulletin may be obtained by writing the Eimco Corporation, Salt Lake City, Utah.

Atomizing Type Aerator for the pre-aeration of sewage and grease removal (Bull. No. 140) and for supernatant liquor treatment (Bull. No. 142) is a new line of aerators of the Pacific Flush Tank Co. The P.F.T. "Atomizing" Aerator consists essentially of a chamber to which is applied a vacuum of approximately 3 in. of water by means of an exhaust fan. This aerator produces a finely divided liquid suspension with the solids entrained in motion in a comparative-

ly large volume of air. The system offers advantages of accessibility, adaptability, freedom from difficulty, flexibility, and rapid results. Applications include pre-aeration, grease removal, trade waste treatment, treatment of digester supernatant liquor, and re-aeration of sludge. The bulletins present a clear and concise treatment of the problems with drawings, tables, and technical explanations of such topics as the basis of design, location of unit, and operation. Write the Pacific Flush-Tank Company, 4241 Ravenswood Ave., Chicago, Ill., for these informative tracts, No. 140 and No. 142.

Supernatant Selectors for Digestion Tanks are the latest idea of the Pacific Flush-Tank Co. for the treatment of this important disposal problem. By means of a slotted supernatant withdrawal pipe, which can be back flushed, it is found that the best supernatant liquor can be removed from any type of digestion tank and supernatant liquor can be removed at a slow continuous rate with a minimum of observation and control as well as a reduction in the amount of supernatant piping and valves required. It is also claimed that the effective capacity of digestion tank for solids reduction is increased. If you are troubled with supernatant liquor problems ask the Pacific Flush-Tank Co. of 4241 Ravenswood Ave., Chicago, Ill., for this interesting information in Bulletin No. 143.

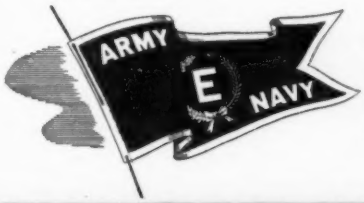
The Wilson Pulsafeeder is a chemical feeder described in Bulletin H-10 of the Wilson Chemical Feeders Co. This feeder, style H, is available in both single and duplex re-agent heads, designed for heavy duty, high pressure service. These feeders are electric motor driven, positive displacement reciprocating type chemical solution pumps, especially developed to provide means of feeding such solutions against high pressures at a constant, manually adjusted rate of feed. A cross-sectional drawing illustrates the simplicity of the feeder's working parts. Tables of ca-



The war has got us more than ever on the alert. New and better Homelite Generators—more portable, more powerful than ever—are daily rolling off our assembly line and going direct to our Armed Forces.

In design, in performance, and in the number of different units, Homelite has made tremendous forward strides. It doesn't mean much to you now—but after the war, your new Homelite Portable Pumps and Generators will be better performers than ever before.

★ ★ ★



Homelite workers have done their job well enough to earn the Army-Navy E—a good indication that they'll do their job well enough to meet your demands when peace is finally declared.

HOMELITE CORPORATION
PORT CHESTER, NEW YORK

★ THE NATIONAL METHOD • OVER 35 YEARS EXPERIENCE ★

GUARANTEED TO RESTORE 95% ORIGINAL CAPACITY

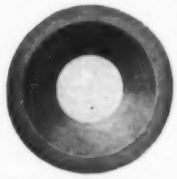
DEFENSE DEMANDS

FULL CAPACITY MAINS

MANY cities that now find their water supply resources sadly overtaxed by the additional thousands of water users in defense industries and nearby army training camps, are turning to the *NATIONAL METHOD of water main cleaning* as an economical means of improving water service.

Cleaning by THE NATIONAL METHOD restores clogged mains to at least 95% of their original carrying capacity, making unnecessary large expenditures for auxiliary pipe lines, increased power at the pumps, new standpipes, etc.

Before Cleaning



After Cleaning

The NATIONAL METHOD

The National Water Main Cleaning Co.

30 Church St. Branches: New York

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910 William-Oliver Bldg., Atlanta, Ga. — 205 W. Wacker Dr., Chicago, Ill.
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84" pipe—Spring Lake, N. J.

FLANGED PIPE

FLEXIBLE JOINT PIPE

BELL & SPIGOT PIPE

SPECIAL CASTINGS

SHORT BODY BELL & SPIGOT SPECIALS

Large stock enables us to make prompt shipments.

CAST IRON PIPE

SIZES 2" TO 84"

Warren Foundry & Pipe Corp.

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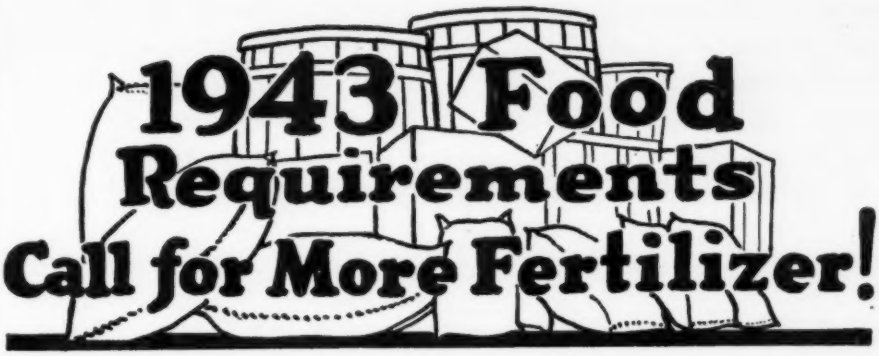
pacities, sizes, and operating characteristics are given for both single and duplex head types. Many advantages are listed for the feeders, these include elimination of packing gland leakage, diaphragm breakage, and corrosion plus rapid operation with micrometer control and accuracy. If interested, write the Wilson Chemical Feeders, Inc., Buffalo, N. Y., for Bulletin H-10.

Ion Exchanges for Industrial Processes and their applications to industrial process work are described in a recent folder of the Permutit Company. Recent development of acid-regenerated cation exchangers and of suitable anion exchangers has widened the fields in which ion exchange materials may be used. Type reactions are presented for cation exchangers which fall in two groups, and for anion exchange or acid removal. The cation exchangers include, Zeo-Dur, Super Zeo-Dur, Decalso and Zeo-Karb. The anion exchanger is a brown translucent granular resin, called De-Acidit. The folder contains a cut-away print of the apparatus in which these materials are used for automatic operation. The operations of cation exchange, acid removal, anion exchange and demineralizing may be applied in many process industries of the following types: recovery of electrolytes in dilute solutions, removal of low concentrations of ionic impurities, separations or fractionations, catalysis, and gas scrubbing. These industries include alkaloids, beverages, biologicals, juices, corn syrup products, drugs, glue, hydroponics, insecticides and others. For further information write to The Permutit Company, 330 West 42nd St., New York, N. Y.

Aero-Filter Design Data are presented by the Lakeside Engineering Corp., in Bulletin 112 containing blueprints of various typical installations together with pictures. Graphs and tables on singles and multiple stage treatment, filter loadings, rates of flow, filter depths, recirculation and distributor size are included in this informative bulletin. Comments and informa-

tion are also presented on clarifiers, scum removal, flow measuring devices, plant hydraulics, filter underdrains, filter media, artificial ventilation, ponding, odors, flies and freezing, as well as specifications for ventilating fans and distributors. A short section is included on Spiraflow Clarifier operation. To obtain this publication write the Lakeside Engineering Corp., 222 W. Adams St., Chicago, Illinois, for Bulletin 112. In conjunction with this bulletin, this company has issued in reprint form an article by J. A. Montgomery, entitled AERO-FILTER RESULTS — PREDICTIONS AND PERFORMANCES. Up to a loading of approximately 2.0 lb. of B.O.D. applied (settled sewage basis) per cubic yard of rock in an Aero-filter, the removal in the filter and clarifier is practically constant at 78 per cent. Excess loadings are accompanied by decreases in efficiency. Properly designed single stage Aero-filter plants will provide 85 to 90 per cent overall reductions of B.O.D. without heavy parallel recirculation. Two stage plants may be expected to give even better results. Top layers of the filters are more efficient than the lower layers but the reduction appears to be dependent on total volume of filter rather than depth. No advantage in efficiency is gained by recirculation of the plant effluent through the primary clarifier. The loading curves presented make it possible to predict plant results or compute size of Aero-filter necessary if used as a roughing filter ahead of second stage filters. As stated this reprint may be obtained from the Lakeside Engineering Corp.

"Wartime Conservation" is the title of a new 96 page booklet just published by the Westinghouse Electric Manufacturing Co. The



It has recently been made plain to us that this year—and for the duration—the responsibility for feeding several hundred million people will rest largely on the United States. We will simply have to produce a record-breaking volume of food.

Greater food production necessitates more fertilizer, despite the fact that the volume of chemical fertilizer formerly produced by the process industries has been greatly curtailed, with many of these plants entirely engaged in war production. Every source of fertilizer must be utilized to the limit, *and that includes sewage sludge.*

Today, burning or burying sewage sludge is waste in a most flagrant form, as it represents curtailment of food production. True, the sludge as it comes from your drying beds, lumpy and caked, cannot be readily used as a fertilizer. But follow the example of the many sewage plants which have turned this expense item of sludge disposal into a source of profit with the Royer Sewage Sludge Disintegrator.

This inexpensive and easily operated machine takes the sludge as it comes from the drying beds and thoroughly shreds, mixes, aerates and further dries it; producing an excellent fertilizer. There is a ready market for Royer-prepared fertilizer, especially among truck farmers and growers-under-glass. Any surplus can be used in city parks.

Royers are available in twelve stationary and portable models, and in sizes for every plant: electric, gasoline engine and belt-to-tractor driven.

THE ROYER

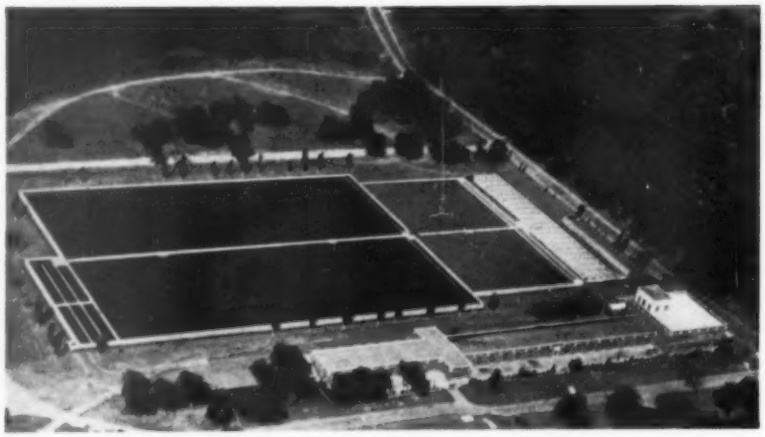
Every sewage disposal plant can contribute substantially to America's increased food production with profit, using a Royer. Write for *new* "Sewage Sludge Utilization Datalog".

ROYER FOUNDRY & MACHINE CO.
170 PRINGLE ST., KINGSTON, PA.

book covers up-rating of motors, thermal temperature loading of transformers, industrial network systems, line equipment and materials; and gives tips on saving and salvaging materials as practiced in the various Westinghouse plants. The booklet also gives many examples of how existing equipment can be made to give better service and greater output by up-rating or rebuilding with more efficient materials than originally used. Recommendations in the book are in line with policies suggested by the W.P.B. for the conservation of critical materials. A copy of booklet B-3206 may be secured from Department 7-N-20, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pennsylvania.

They Save With

TENNESSEE CORPORATION Ferri-Floc FERRIC SULPHATE



Dallas, Texas — Water Purification Plant

Mr. L. C. Billings, Superintendent and Chief Chemist of the Municipal Water Purification Plant in Dallas, Texas, conducted extensive tests with FERRI-FLOC as a secondary coagulant to replace alum. As a result of these tests, FERRI-FLOC has been used continuously for over a year.

Although the cost of FERRI-FLOC delivered in Dallas is approximately 10% higher than alum, an over-all saving of more than 30% has been effected. The following data is taken from routine operation reports:

	ALUM	FERRI-FLOC
Filtered water turbidity	0.23	0.09
Average bacteria filt. water	11	4
Average water wasted daily	113,495 gals.	16,200 gals.
Average Coag. Fed. gr. gal.	.469	.303
Cost per 1,000,000 gals.	$0.96	$0.68

Congratulations, Mr. Billings, on your contribution towards economy!

Abundant supplies available — no priorities required

TENNESSEE CORPORATION

ATLANTA, GEORGIA LOCKLAND, OHIO

Dissolved Oxygen Test Kit, type 01, is a new product of the Worthington Pump and Machinery Corp. Their Bulletin W-210-B28 shows this kit and lists the parts for the determination of Dissolved Oxygen by the Winkler Method. For Safety's Sake, boiler feed water should be tested regularly and this new kit provides simplicity, accuracy and portability to do the work. The method of using the Worthington Counter Current Sample Cooler to insure accuracy of sampling by proper cooling of the sample, is shown in diagram, as is the design of the cooler itself. Copies of this Bulletin W-210-B28 may be obtained from the Worthington Pump and Machinery Corp., Harrison, N. J.

Double Displacement Proportioning Equipment using pH control is described in Publication No. 4009 of the Cochrane Corporation. The purpose of this double displacement acid feeding is primarily to feed very small quantities of dilute sulphuric acid continuously to control the acid-alkaline balance or pH in boiler feed water as delivered from hot-process water softeners. It is also suited to correction of alkalinity of zeolite softened waters and can be used for feeding other corrosive solutions. The proportioning is by displacement in which two tanks are utilized and the chemical solution separated from the water by a layer of thin oil, such as kerosene. This system eliminates pumps, and moving parts, and is simple in construction depending upon the proportioning of one fluid to another by utilization of the pressure loss through the metering element, such as an orifice or Venturi tube. Complete description with illustrations is given in Bulletin Publication 4009 now available from the Cochrane Corp., 17th and Alle-

gheny Ave., Philadelphia, Pa.

Synchronous-Motor Control is the subject of a new illustrated 12-page bulletin (GEA-1724-D) recently issued by the General Electric Company. The bulletin explains what synchronous motor control is and how it works, in starting accelerating, synchronizing, normal running, pull-out and undervoltage protection. The operation of both magnetic and semi-magnetic types of full- and reduced-voltage synchronous controls is described in detail. Also listed and described are the several metal cabinet type enclosures available for protecting these controls. Complete information may be had by writing the General Electric Company, Schenectady, N. Y., for Bulletin GEA-1724-D.

"Victory Production and Maintenance News," previously issued as "Victory News" by Allis-Chalmers endeavors to help industry find out how to keep its production machines running during the war. Inviting an exchange of maintenance ideas from equipment operators, the publication carries in addition tips from Allis-Chalmers engineers on the proper maintenance of the hundreds of products manufactured by this company, supplemented by production stories in news and pictures, showing new ways to increase war production. A handy index lists maintenance articles appearing currently in the leading trade papers and an interesting feature is the "Pet Maintenance Peeve" column. Any one interested in stepping up maintenance to meet wartime needs in their plants can obtain this publication regularly by writing the Allis-Chalmers Mfg. Co., Milwaukee, Wisconsin.

Photoelectric Relays for automatic control are easy to apply and easy to maintain according to a folder just released by the Electronic Control Section of the General Electric Co. A table of application data and pictures of various types of general-purpose relays are shown with accessories such as transformers, light sources, lenses, masks, and filter caps. Production may be speeded electronically by use of this equipment for such work as counting, controlling, limiting, and sorting. For further information write the General Electric Co., Schenectady, N. Y.

Vitrified Clay Septic Tanks which embody "modern design" are described in a folder of the Robinson Clay Product Co. These tanks, made of salt-glazed, vitrified clay, "the material everlasting" come in various sizes and capacities. Sizes,

FOOTPRINTS IN THE SANDS OF TIME

OVER 13,000 MILES
OF THEM AND WE'RE PROUD OF 'EM!

Since 1928 HILL-HUBBELL FACTORY PROCESSED STEEL PIPE PROTECTION has consistently made trail breaking footprints. We are charting a course to even bigger and better accomplishments when this necessary war is won.

Right now, of course our production facilities are directly geared to the war's demand for Protected Steel Pipe.

Hill-Hubbell men and equipment are at work in these leading mills:

Jones & Laughlin Steel Corporation
National Tube Company
Spang Chalfant, Inc.

GENERAL PAINT CORPORATION
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• EXPORT OFFICE SAN FRANCISCO CALIFORNIA U S A •

LEADITE
The Pioneer Self-Caulking Material for C. I. Pipe

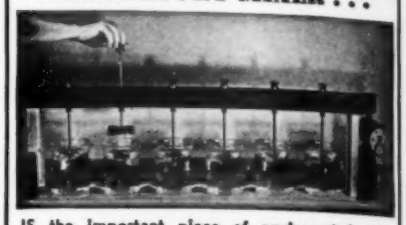
LASTING BOND !

THE LEADITE COMPANY
Girard Trust Co. Bldg. Philadelphia, Pa.

No Caulking

ratings, and specifications for both standard and parallel systems are presented in tabular form showing the capacity, population tributary handled, and dimensions. The folder tells why septic tanks should be installed, why salt-glazed vitrified clay has been proven through centuries of use, and why the new "modern design" makes it possible for the entire system to operate as one unit because of the unique location of opening between sections. Besides instructions for installing this type of septic tank, a number of superior features are listed, including simplicity and inexpensiveness, banishment of cesspool, permanence, provision of "long flow," ease of expansion or enlargement of the installation. A copy of this descriptive folder may be obtained from The Robinson Clay Product Co., 101 Park Avenue, New York, N. Y.

THE Phipps & Bird
LABORATORY MIXER . . .



IS the important piece of equipment in the Modern Water Works Laboratory. Now being used by leaders in water works research. Many superintendents and chemists have been able to reduce their chemical costs by the control of chemical dosages with this mixer. Write for literature.
PHIPPS & BIRD, INC. Richmond, Va.

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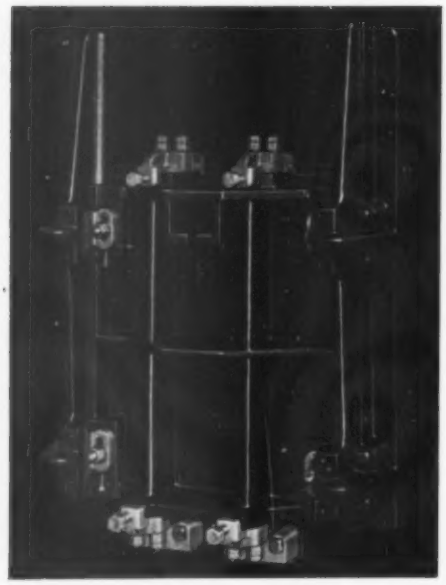
Pioneer Producer of GREENSAND ZEOLITE MINERAL



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Distinguished by precision workmanship

If you haven't seen a National Sluice Gate you can't appreciate its unusual combination of giant strength and velvet-smooth operation. Finest materials, ample sizing, painstaking workmanship and assembly assure you of a gate which really shoulders the load. Send for descriptive literature.

NATIONAL MACHINE WORKS
1559 N. Sheffield Ave., Chicago, Ill.

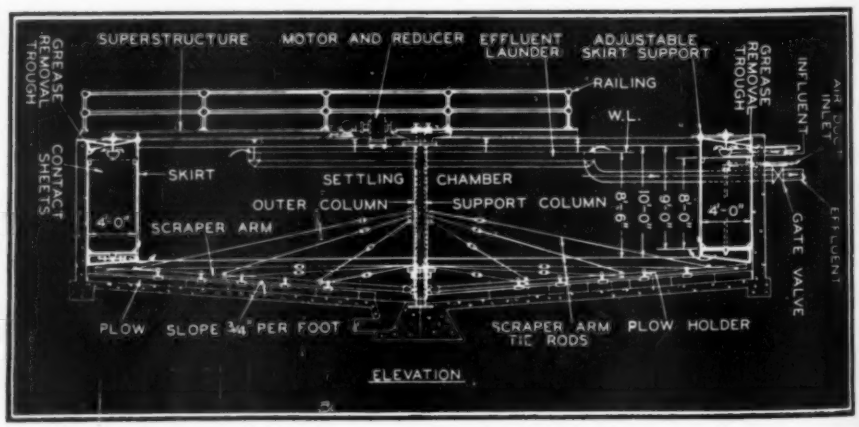
EQUIPMENT NEWS

The "Clari-filter"

Lakeside Engineering Corporation of Chicago has recently announced the "Clari-filter"—a new type of contact filter for sewage treatment.

As the accompanying line-drawing indicates, the "Clari-filter" consists of a contact filter at the periphery and a clarifier mechanism built within the walls of a circular clarifier.

The incoming settled sewage is equally distributed at the top of all of the contact plates. It passes downward between the plates against a rising current of air. Since the arms of the clarifier mechanism extend under the contact cells there is no need for hopper bottoms beneath the contact beds. The bottom of the skirt between the contact filter and settling compartment is demountable, thus permitting easy access to the air diffusers without disturbing the contact plates, the nature of which is not disclosed in the announcement.

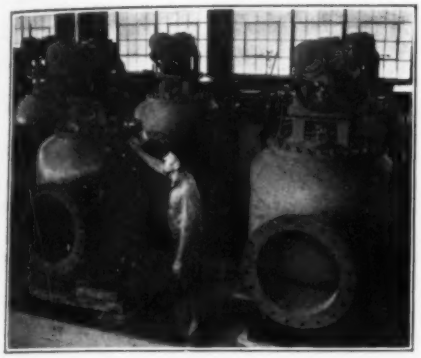


The aeration scheme serves simultaneously as a floc builder and means of grease separation, the grease being floated off into a skimming trough within the annular contact ring.

For further details on the new "Clari-filter" and its adaptation as a combination unit with the "Aero-filter" for economical high degree sewage treatment request Bulletin 110 from Lakeside Engineering Corp., Chicago, Ill.

Elliott Self-Cleaning Strainers

The Elliott Type K Self-Cleaning Strainer may not be new to some of our readers; to many, however, it will be. It is designed for the removal of fine dirt and sand as well



as finely divided suspended particles of any other nature from waters. It is said to require no more attention than is given a centrifugal pump.

This strainer is continuously and automatically cleaned by back-flushing of the ingenious straining element (basket), consisting of a cylindrical frame holding a series of straining cartridges.

A rotating element, operated by the motor at slow geared speed, blanks off the cartridges in succession while one after another is back flushed by a portion of the strained water.

The body and cover are of cast-iron; the slotted strainer cage is of brass. The strainer cartridges are fabricated from alternate layers of flat and corrugated copper strips securely fastened together—these being inserted in the basket slots from above.

Amongst advantages cited for the Elliott Strainer are small space requirements, low power consumption, easily removable training cartridges, without removing the cage.

The Elliott Strainer is available in sizes from 4 in. to 24 in. for pressures from 25 lbs. to 125 lbs.

gauge. For Bulletin A-8 decribing the Type K Strainer as to construction and operating details, write Elliott Co. (Accessories Dept.), Jeannette, Pa.

Reeves Combines Variable Speed Mechanism and Gear Reducer in Single Compact Unit

A new unit in the line of variable speed control equipment built by Reeves Pulley Co., Columbus, Ind., is the Reeves Reducer-Type Transmission.

This drive, which consists of the standard Reeves Variable Speed Transmission with built in Speed Reducer, has been developed to meet the many requirements for accurate speed control and speed reduction combined in one compact completely enclosed unit. An outstanding advantage of this Reeves drive is that far less mounting space is needed to obtain the lower range of speeds which formerly required the use of

SMITH EQUIPMENT

THE A.P. SMITH MFG. CO. EAST ORANGE, N.J.

Symbol of Quality Since 1889

A NAME TO REMEMBER

When you want good Water Works Equipment

It is an easy name to remember and also one worthwhile. Our experience gained in over 50 years of service enables us today to stand ready to help you get the best water works equipment available. Our men are experts in their profession and their skilled craftsmanship is known the world over.

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WATER METERS — disc, current, disc-compound, current-compound.	Write for Booklet 42MF
VALVES—HYDRANTS—for heavy and high-pressure service.	Write for Booklet 42VH
TAPPING AND INSERTING VALVES, machines and accessories.	Write for Booklet 42M
CORPORATION AND CURB COCKS, PIPE CUTTERS, REPAIR SLEEVES, REMOVABLE PLUGS, INDICATOR POSTS, ETC.	Write for Booklet 42 Misc.

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Valves and Hydrants — Valve Inserting Machines — Tapping Sleeves — Tapping Valves — Hat Flanges and Water Meters
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THE A. P. SMITH MFG. CO., EAST ORANGE, N. J.

STEWART SEWER CLEANING EQUIPMENT
MACHINES LEASED OR SOLD

WOODEN & STEEL SEWER RODS • STEEL TAPES

ROOT CUTTERS • SEWER CLEANING BUCKETS • CABLE

JUMBO NO. 10 HEAVY DUTY WOOD RODS

Made of Selected Hickory with strong Malleable Iron Couplings, in 2½, 3, 3½ and 4 ft. lengths. Triple Lock, impossible to buckle or uncouple in the sewer. The tongue and groove feature eliminates wear on hook, increasing the length of service.

FREE TRIAL — THE RODS MUST PAY FOR THEMSELVES

Write today for Complete Catalog

MANUFACTURING SEWER CLEANING EQUIPMENT SINCE 1901

★ ★ ★ W. H. STEWART ★ ★ ★

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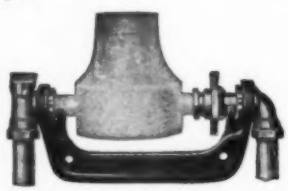
INQUIRIES INVITED
on all Problems of
WATER TREATMENT

Whether your problem of water rectification is large or small, we have a form of equipment to serve your needs. We manufacture and install equipment for Gravity Filtration and Softening Plants; Pressure Filters and Zeolite Softeners; Swimming Pool Recirculating Appliances; and Water Treatment Units of all types.

ROBERTS FILTER MFG. CO.
607 COLUMBIA AVE.
DARBY, PA.

FORD YOKES

Before the FORD YOKE there was no yoke for water meters. In pioneering this development it was Edwin H. Ford's firm conviction that every meter deserved more consideration than to be installed in a service like any fitting or piece of pipe.



Now, with the trend more strongly than ever toward greater accuracy and more frequent testing, the easy and trouble-free accessibility of a water meter set in a Ford Yoke makes this proven and perfected setting device even more worth while.

It will pay any water works to investigate and consider carefully the many advantages Ford Yokes have to offer.

FORD METER BOX CO.,
WABASH, IND.

auxiliary speed reducing equipment.

The Reeves Reducer-Type Transmission is available in two enclosed designs — horizontal and vertical,

which may be mounted in any convenient or desired position. Each design is available in a wide range of speeds and in capacities from 1 to 7½ horsepower inclusive. The Transmission in various sizes produces ratios of speed variation from 2:1 through 12:1 and the reduction gears provide ratios up to and including 6.9:1. Speed changes are effected by turning a handwheel; or, if completely automatic regulation is desired, it is available by mechanical or hydraulic methods.

The reduction gears are mounted on the variable shaft of the Transmission, this shaft serving as the input shaft for the reducer unit. The assembly of the reducer unit may be made in many different positions.

The gear reduction unit, which is built integral with the transmission, has been especially developed for the severe torque demands of variable speed service. The helical type of gear reducer has been adopted because of established high efficiency and quiet operation. Since the teeth of a helical gear are cut at an angle to the axis, two or more teeth are in contact across the face of the gear at all times, this providing smoother transmission of gear load from one tooth to the next, producing better load distribution and improving the wearing properties of the gear.

The Reeves Reducer-Type Transmission in either horizontal or vertical design may be equipped for individual motor drive by use of a Reeves motor base. Connection between motorand constant speed shaft of the Reeves drive may be either silent or roller chain and sprockets, multiple V-belts or pinion and gear.

New Floor Stand Hoists for Screw Stem Gates

The Rodney Hunt Machine Co. of Orange, Mass., has recently designed a completely new line of floor stand hoists for screw stem gates such as are used on canals, reservoirs, and other water controlling projects. The new type are unusually compact, strong and easy to operate. They include the use of the finished hardened gears, most efficient seals and compact anti-friction bearings. The handles are removable. This new Rodney Hunt hoist line offers the absolute minimum crank effort for heavy duty lifting. The floor stands have selective two-speed gear ratios. They permit the gates to be stopped and held at any stage of opening.

These new stands are made in a complete range of sizes for different loads.

For further details write Rodney Hunt Machine Co., Orange, Mass.

WITH THE MANUFACTURERS

Manufacturers Elect Fred Stuart

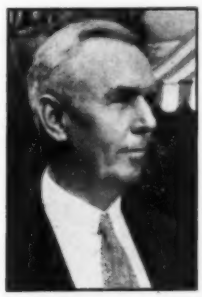
At a recent meeting of the Executive Committee of the Water Division of the Association of Water and Sewage Works Mfgr's., held in New York City, Fred Stuart, President of the Stuart-Brumley Corp. of Baltimore and the Associated Alum Corp. was elected Chairman of the Water Division.

Fred Stuart

Stuart's career in the water supply field started when he was plant operator and chemist at Daytona Beach, Fla. When he entered the commercial field with Industrial Chemical Sales Co. he made a niche for himself in the success attained in introducing activated-carbon ("Nuchar") with the water treatment field. He conceived of "Black Alum" and "Activated Alum," obtained financial backing and built his own plant to produce it. Stuart-Brumley Corp. is the firm established to handle all sales of the two filter alums and other materials and equipment used in the water and sewage fields.

Charlie Richardson 40 Years With Builders-Providence

On a cold day in February, 1903, a young man knocked at the portals of the venerable Builders Iron Foundry in Providence, R. I. Then, as now, Zechariah Chafee was President; two renowned engineers, Clemens Herschel and Frederick N. Connet were respectively, Consulting Engineer and Chief Engineer.



Charlie Richardson

At that time "The Venturi Meter" consisting of the "Venturi Tube" invented by Herschel and the "Type D Venturi Register" invented by Connet was just beginning to ful-

· 1879 ·
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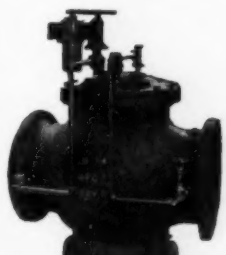
AUTOMATIC VALVES

ALTITUDE VALVES • SURGE • RELIEF • BACK PRESSURE VALVES

ALTITUDE VALVES
for
Control of elevation and heads into and out of tanks, basins and reservoirs.
1. Single acting.
2. Double acting.
3. Combination assembly for three or more automatic operations.

COMBINATION VALVE
Combination automatic control both directions through the valve.
A self-contained unit, with three or more automatic controls.



REMOTE CONTROL VALVE
Electric remote control—solenoid or motor can be furnished.
Adapted for use as primary or secondary control on any of the hydraulically controlled or operated valves.

FLOAT VALVES • REDUCING AND REGULATING VALVES

ROSS VALVE MFG. CO.
INCORPORATED
P. O. BOX 595, TROY, N. Y.

RODNEY HUNT

FLOOR STANDS

Photo shows an improved Rodney Hunt Floor Stand. It is equipped with efficient anti-friction bearings and is more compact and lighter than other models. This floor stand is available in a wide range of sizes and gear ratios for various loads. Rodney Hunt also makes timber and metal gates, gate hoists, flap and mud valves, and other types of dependable canal equipment, a field in which Rodney Hunt has pioneered for over 100 years.

Write for Special Catalog Today.

RODNEY HUNT

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118 Lake Street, Orange, Mass., U. S. A.

Plan and design hydraulic works *quicker-better*

Here at last is the hydraulic engineering profession's own handbook, comparable to the standard handbooks available in other fields of engineering. A new, complete manual of time-saving, up-to-date information, tables, diagrams, formulas, pointers.

HANDBOOK OF APPLIED HYDRAULICS

Compiled by a Staff of Specialists
CALVIN VICTOR DAVIS
Editor-in-Chief, Project Engineer, Fontana Dam, N. C., T.V.A.
1,100 pages, 6x9, 645 illustrations, $7.50.

This important new Handbook treats in a single volume all major phases of hydraulic engineering. Covers hydrology, water supply, sewerage, water power, hydraulic structures, and all other related subjects essential to successful solution of on-the-job problems. Eighteen specialists contribute their experience and research and give full information on methods and practices for planning and designing efficient hydraulic works.

23 Big Sections Cover:
Hydraulic formulas
Hydrology
River Regulation
Gravity Dams
Arch Dams
Buttress Dams
Spillway Crest Gates
Canals, Flumes, etc.
Hydroelectric Plants
Hydraulic Machinery
Water Distribution
Sewerage, etc.

Gillette Publishing Company
330 South Wells Street, Chicago, Illinois

fill its mission of service to the world.

This young man Chas. G. Richardson was soon engaged as Mr. Connet's assistant and in due course acquired assistants of his own. Notable among these are such neophytes as Dave Purdie and Alan Wood—a couple of young men who have now been with Builders a mere twenty-five years or thirty—well, perhaps thirty-five—years.

During the subsequent years, Charlie made frequent pilgrimages to be helpful to those wrestling with the problems of bringing pure water to, and taking waste water from the cities, towns and villages of the nation. He has been active in the American Society of Civil Engineers, the American Water Works Association and the Federation of Sewage Works Associations.

The many friends that Charlie Richardson has acquired in the course of these pilgrimages, will be interested in knowing that a festive occasion was held in Providence on February 16, 1943 at which his associates in Builders gave a dinner in his honor. On this occasion of his completing 40 years with the company, his associates presented him with a sterling bowl (for Mrs. R. perhaps); but, for himself a very fine movie camera with which a color film was shot just so that Charlie would have the record of the evening for his "memory book."

Mathieson Receives Army-Navy "E"

The Mathieson Alkali Works (Inc.) has received the Army-Navy Production Award for high achievement in the production of chlorine, synthetic ammonia, caustic soda,

high test calcium hypochlorite, sodium chlorite, sodium methylate, and other chemicals vitally needed for the nation's war effort. The award was made specifically to Mathieson's Niagara Falls Plant.

In the accompanying picture, from the left, are Lieut.-Commander

HYDRO-TITE

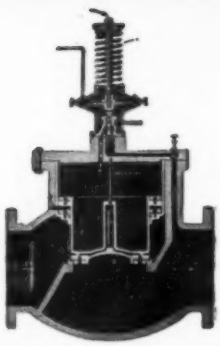
The dependable self-caulking joint compound for jointing cast iron water mains — uniform — easy to prepare — easy to use — in service for more than 30 years.

HYDRAULIC DEVELOPMENT CORPORATION
50 Church St., New York, N. Y.

FIBREX — A sanitary packing used like braided jute — will not breed bacteria — 30% lighter than jute — put up in 60 pound reels.

DRY BRAIDED Fibrex

Stop Check Single Acting Altitude Valve



This valve installed in the upstream line automatically maintains a uniform water level within 3" to 12" variation to prevent any tank overflow; also, by means of the internal "stop check" piston assembly, prevents loss or return of storage water back through the valve—making the valve very desirable for use where metered water is purchased, or wherever it is imperative that there be no possible return flow.

This valve may be fitted with "Differential" Control for delayed opening, if desired.

Write for specifications and prices.

GOLDEN-ANDERSON VALVE SPECIALTY CO.
Fulton Building Pittsburgh, Pa.

AER·O·MIX
AERATOR—MIXER

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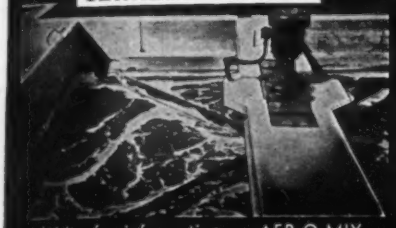

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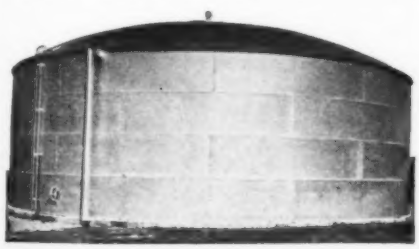

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George W. Eighmy, U.S.N.R., Col. Harry A. Kuhn, of the Office of the Chief, Chemical Warfare Service, Washington, D. C.; G. W. Dolan, Mathieson's Executive Vice-President; and Frank A. Sweet, Chairman of the Employees Committee of the Niagara Falls Plant.

In his address of presentation Colonel Kuhn had the following to say concerning Mathieson's contributions to the war effort.

"This plant started operations on Thanksgiving Day, 1897; we in the military service have had occasion to be thankful for this plant in two wars," said Col. Kuhn. "In 1917, the Chemical Warfare Service called on this plant to furnish material and to furnish men to help operate our Edgewood Arsenal. Today, every branch of the Army and the Navy call on this plant for chlorine, caustic soda, for high-test hypochlorite, ammonia, and other products. These products are just as vital to the war as are the tanks, the airplanes, the explosives, the gasoline and the synthetic rubber in which they are used. The chlorine which made possible the pure water furnished our troops on Guadalcanal played just as vital a part in winning that battle as the high explosive shell that blasted the Japs from their rat holes."

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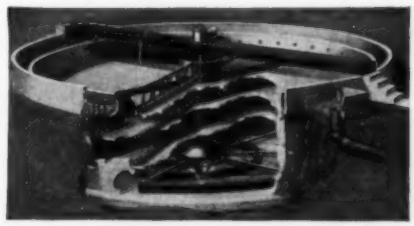

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handling Safety Devices, now widely used in the sewage field, is completing its seventh addition to its main factory since Pearl Harbor.

The new addition, which is five thousand square feet, will house the assembly and production line. The company's policy of manufacturing all parts in "VAREC" approved equipment "under one roof" is now in operation. This greatly facilitates keeping production schedules on time.

Glamorgan Pipe Receives Production Award

Virginia's Governor and Congressman Honor Company With Their Presence

Last month just barely in time for a paragraph mention in our February issue we received word from Washington that the Lynchburg, Va., "house" of Glamorgan was on the list to receive the prized Army-Navy "E" for production efficiency

in the war effort. On March 9th the presentation ceremonies were held in Lynchburg, Va., at the plant of Glamorgan Pipe and Foundry Co.

The accompanying picture, just received, reveals that the long established foundry of Glamorgan was honored by the Governer of Virginia —Colgate W. Darden, Jr., (extreme left) and member of Congress Clifton A. Woodrum of Roanoke, Va. (extreme right), by their presence for the presentation. Representative Woodrum acted as master of ceremonies, in fact.

Next to the Governor is Anthony F. Lloyd, chosen as the Glamorgan employees' representative to receive the "E" pins. Colonel John L. Person acted for the Secy. of War and Lieut. Wm. H. Geppert for the Secy. of the Navy. Next to Representative Woodrum stands Glamorgan's president—John D. Capron.

In his speech of acceptance Mr. Capron stated: "And this is an appropriate time to renew our pledge to back up our men on the fighting fronts."

Glamorgan is one of the oldest names in the pipe foundry world, and Lynchburg and Virginia are proud of its achievements—now, and over the years.

ACIPCO Also Awarded Army-Navy "E"

Just as we are going to press we have a Washington release announcing that American Cast Iron Pipe Co. of Birmingham, Ala., has also been chosen to receive the Army-Navy "E" for war production achievements which merit the award for "excellence in production."

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To Monsanto

Already the holder of 12 other war production awards, Monsanto Chemical Co. has recently received a Triple "E" Award from the Army and Navy when three more Monsanto plants distinguished themselves as winners of the Army-Navy

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Bristol Appointments

L. G. Bean Made U.-Pres. in Charge of Engineering and Sales; H. E. Bean Becomes Sales Manager

Howard H. Bristol, President of The Bristol Co., Waterbuy, Conn., manufacturers of automatic control and recording instruments announces the appointment of L. G.

L. G. Bean H. E. Bean

Bean as Vice-President in Charge of Engineering and Sales from the position of Vice-President and General Sales Manager which he has held since 1939.

Harry E. Bean has been made Sales Manager.

L. G. Bean was graduated from Worcester Tech in 1920 after an interrupted course in War Service in World War I when he attended the U. S. Coast Guard Academy and served for two years as Engineering Officer in the Coast Guard. In 1920 he joined the Bristol Co. as a sales engineer and has progressed steadily ever since, through the position of Ass't. Chief Engineer of the Company.

H. E. Bean, a graduate of Western Kentucky State College in 1915, joined The Bristol Co. in 1920 and has served as District Manager of various Bristol offices and later Field Sales Manager, supervising activities of the company's branch factories in Chicago, Akron and San Francisco and all District Offices of Bristol from coast to coast.

Magnus Chemical Enters Feedwater Treatment Field

New Division Headed by J. D. Holmes.

The Magnus Chemical Co., Inc., Garwood, N. Y., announces the appointment of J. D. Holmes as Manager of its newly organized Feedwater Treating Division.

Mr. Holmes has had a wide range of experience in the treating of feedwater, having covered all types of stationary plants, railroads and steamship lines throughout the United States, Canada and the West Indies, under widely divergent conditions.

One of the unique parts of the Magnus Feedwater Treating plan is the loaning to clients all chemical water testing equipment needed for the maintenance of perfect control, and the furnishing of all testing reagents and indicators free.

Analytical methods and control features are being brought into such simple form that any engineer or fireman may maintain essentially as effective control over all adverse conditions found in his plant as would a trained but less experienced technician.

A feature is the Graph Chart Control. This is simply a system of recording results of water analysis on a special chart upon which maximum and minimum tolerances of each element to be controlled is established.

Additional information concerning the Magnus method of treating boiler feedwater can be obtained by writing to the Feedwater Treating Division, Magnus Chemical Co., Inc., Garwood, N. J.

Charlie Moore and "Friends"

In our January issue an item announced that the Joshua Hendy Iron Works of Sunnydale, California, had purchased the Pomona Pump Co. of Pomona, California, and its subsidiary Westco Pump Div. of St. Louis. Also that earlier the Crocker-Wheeler Electric Mfg. Co. of Ampere, N. J., producers of electric motors, generators and flexible couplings, had been purchased by Hendy.

Too late for use in January, the accompanying picture was received. On the left is Crocker-Wheeler's General Manager—A. J. M. Baker; on right Pomona's General Manager —Geo. A. McKenna; and in center Chas. E. Moore, President of the Joshua Hendy Iron Works, who engineered the acquisition and combination of these three important companies.

J. W. Gardner Dies Old-School Industrialist Long President of Gardner-Denver Co.

The death of Mr. J. W. Gardner of Quincy, Ill., has again brought into focus the progressive career of one of the country's old-school industrialists. He was almost 80 years old and had been associated with the Gardner-Denver Co. from the age of 18 until retiring a few years ago.

Under Mr. Gardner's able direction, the Gardner-Denver Co. (originally the Gardner Governor Co.) grew from a small concern employing forty men to the present company with its payroll of more than two thousand employees. His unusual ability to select, train and inspire his associates was one of his greatest contributions to the growth and progress of the business. During his period of active management, Mr. Gardner served as President, Chairman of the Board and finally as Chairman of the Executive Committee.

Mr. Gardner's industrial activities resulted in national recognition. He was past president of several national associations and societies, including The National Metal Trades Association, The National Foundry Men's Association, The National Compressed Air Society and The National Hydraulic Society. He also served as Director of The Illinois Manufacturers' Association.

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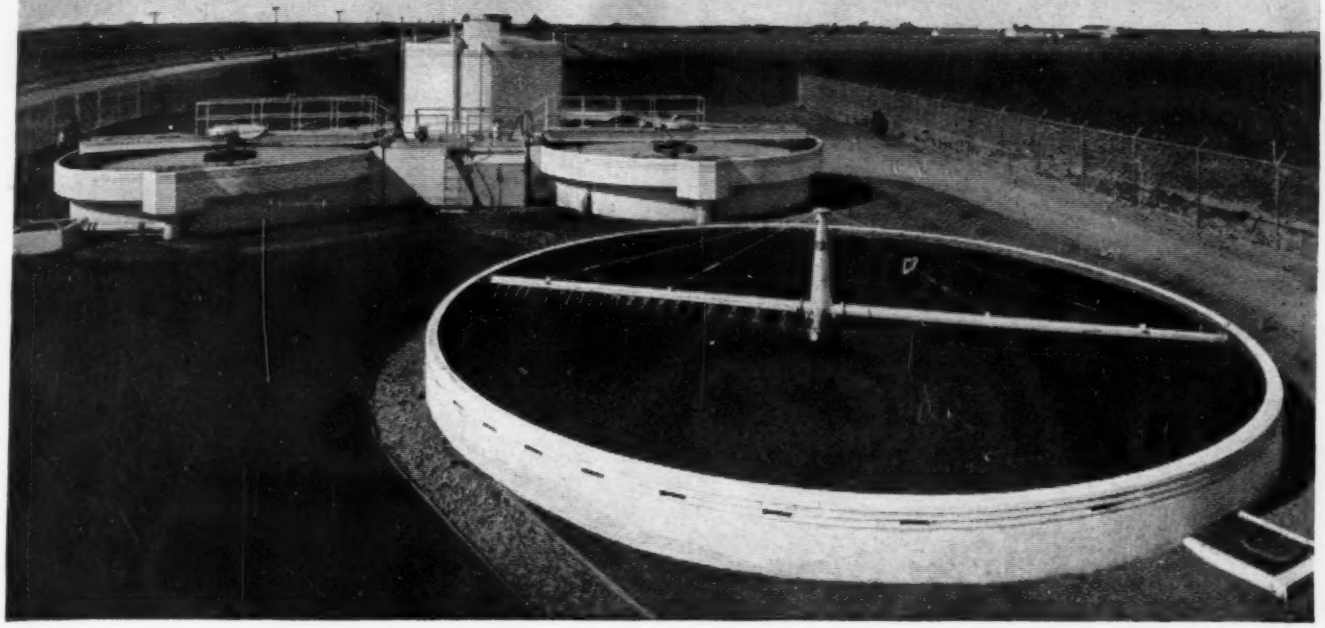
BIOFILTRATION



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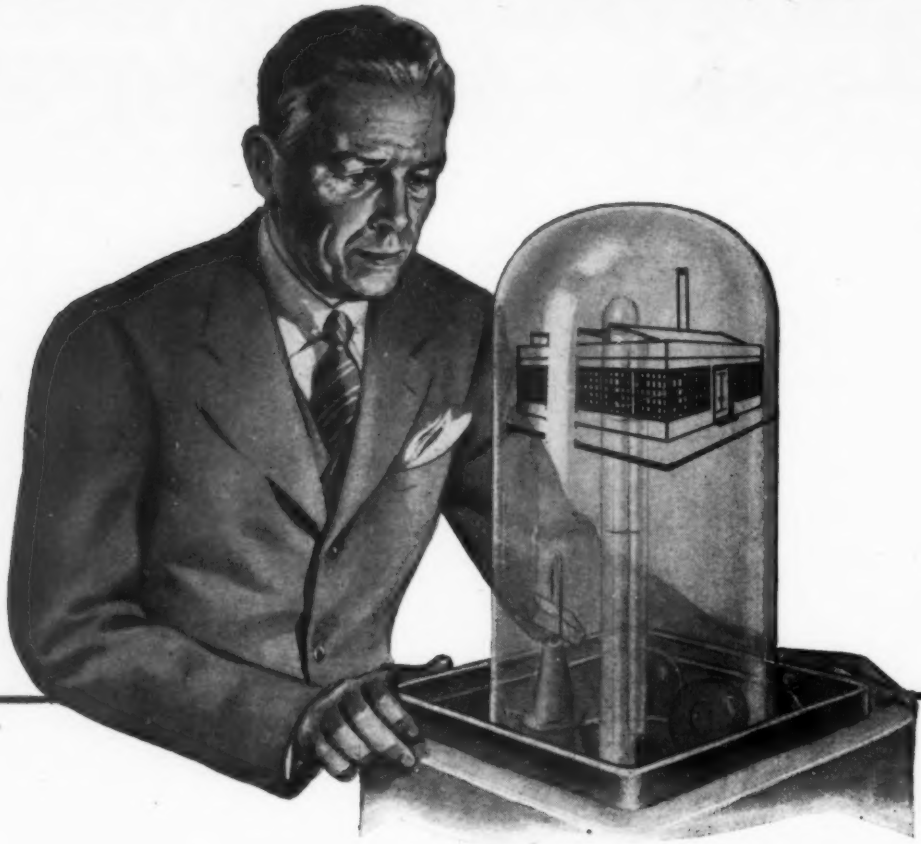

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Although chlorination is not a substitute for adequate filter capacity, it can often go a long way to carry you safely through a period of increased demand that puts an abnormal burden on your plant.

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